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RESUMÉ

LECTURES ON ANATOMY

BY

EDMOND SOUCHON, M. D.

PROFESSOR OF ANATOMY AND CLINICAL SURGERY, TULANE
UNIVERSITY OF LOUISIANA,

FELLOW OF THE AMERICAN SURGICAL ASSOCIATION.

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PREFACE.

This simple resumé of the Lectures on Anatomy, delivered before the Medical Students of the Tulane University, is intended solely to assist them in the study of the most important points of this branch, which is one hard to teach, hard to learn, hard to remember and yet of great importance, since it is the foundation of all medical studies.

It is a branch which can not be guessed.

It is one which can only be learned practically, and which it is almost impossible to the greatest number to study after leaving the college; hence another reason for studying it well once and at once.

This resumé should be carefully studied at home by the students before coming to the college. The resumé of the coming lecture should be studied a day or two in advance to profit well by the lecture, the dissections, the drawings and the microscopic preparations which may be exhibited at the lecture. The resumé of the lecture of the day should be well studied at night. After a set of organs have been described the resumé of those organs should be studied over.

All that does not require to be seen to be remembered has been left out of this resumé.

In order to assist the students in studying over and over, a list of numbered questions with corresponding numbers in the text has been placed at the end of the book. It will enable them to examine themselves and to become familiar with those questions, which will be the same that they will have to answer in the examining room.

To assist the students also in the *Dissecting Rooms*, the posterior surface of the organs is described last, though systematically it should come second. But as this study implies a removal of the organ or a great disturbance in the parts not yet studied, those parts should be studied first and then the posterior surface.

EDMOND SOUCHON, M. D.

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RESUMÉ OF GENERAL HISTOLOGY.

CELLS.

- 1 **Shape.** Cells are spherical or lenticular, polygonal or cubical, cylindrical or columnar, conical or pyriform, spindle-shaped, stellate and prickly.
Number. Cells form either single layers or many layers (stratified or laminated).
- 2 **Structure.** Cells are composed of a *cell-membrane* and of *cell-contents* or protoplasm, which is a *fluid* containing *granulations*, pigment and a *nucleus*, containing itself a fluid and a *nucleolus*.
Some cells, such as the white blood corpuscles, have *no cell membrane*, and are formed of a mass of jelly-like matter with or without a nucleus.
The nucleus is a *little cell* in itself.
Some cells, such as the blood cells in man, have *no nucleus*.
Some cells have *many nuclei*, such as the giant cells of the red marrow of bones.
The *nucleolus* is comparatively *unimportant*.
- 3 **The Vital Properties of Cells** are absorption, assimilation, growth, secretion, excretion, motion (ameboid or ciliated), and death or destruction (by desquamation, dissolution, fatty, pigmentary or calcareous degeneration), and multiplication by gemination or budding, and by segmentation or cleavage.

EPITHELIAL TISSUE.

- 4 **Definition.** Epithelial tissue is formed of cells lining the surface of the skin, mucous membrane and glands. It is almost always stratified.
The epithelial tissue of the skin is called the *epidermis*; that of the mucous membrane and glands is called the *epithelium*.

ENDOTHELIUM.

- 5 **Definition.** Endothelium is the cells lining the interior of the heart, blood vessels and serous membranes. It is always in a single layer.

CONNECTIVE TISSUE.

- 6 **Varieties.** It presents the following varieties:
1st, the transparent;—2d, the granular;—3d, the fibrillated (presenting lymph spaces and lymph corpuscles);—

4th, the corpusculated (presenting the so-called connective tissue corpuscles);—5th, the pigmented;—6th, the mucoid or gelatinous formed by large connective tissue corpuscles which branch and anastomose so as to form alveoles;—7th, the adenoid, lymphoid or retiform, formed of branched corpuscles forming alveoles filled with lymphoid cells.

FIBROUS TISSUE.

- 7 **Definition.** Fibrous tissue is formed of closely united bundles of connective tissue.

ELASTIC TISSUE.

- 8 **Definition.** Elastic tissue is composed of flattened band-like fibres much wider than those of the connective tissue. It curls when cut.
Varieties. It presents:—1st. A variety characterized by narrow fibres.—2d. A variety characterized by broad fibres with notched edges and perforated substance.

ADIPOSE TISSUE.

- 9 **Definition.** Adipose tissue is formed of fibrils of connective tissue in the meshes of which are deposited fat cells.
Structure. Fat cells have a distinct membrane, contain fluid oil and a nucleus.

GLANDULAR TISSUE.

- 10 **Varieties and Characters.**

1st. The **Racemose Glands** resemble a bunch of grapes.

The dilatations are the *acini*, and the stems, large and small, are the *ducts*.

They are simple or composite.

2d. The **Tubular Glands** have the form of a canal.

They are simple or composite, and straight or convoluted, and with a mere closed extremity or an extremity which terminates by a dilatation or pouch.

3d. The **Open Glandular Follicles** are vesicles which present a small opening through which the secretions are discharged.

4th. The **Closed Glandular Follicles** are vesicles deprived of opening and discharging their contents by rupture (ovaries). They are not to be confounded with the follicles of the lymphoid organs, such as isolated follicles of the small intestines, Peyer's patches, lymphatic gland follicles.

- 11 **Structure of Glands.** In a general way the *bottom* of the gland is the secreting part and is usually lined and filled with peculiar *gland cells*;—the *excretory ducts* are lined by a columnar epithelium.

PECULIARITIES OF THE TISSUES.

N. B.—Peculiarities are points which are usually special to a tissue or organ alone, seldom to two or three.

12 **Peculiarities of Epithelial Tissue.**

It is found on all surfaces in contact with the exterior directly (skin, mucous surfaces)—It is always laminated.—The Deep Cells are always round or oval and soft.—The Superficial Cells have little or no vitality.—It is deprived of vessels.—Nerve Fibrils form hair-cells, in some places, which terminate between the cells.

Peculiarities of Endothelium.

It is found in the cavities which do not communicate with the exterior (serous surfaces)—It is always in a single layer.

13 **Peculiarities of Connective Tissue.**

The most common variety is the fibrillated.—The fibres are round and wavy.—The corpuscles present branches or processes.—It has no capillaries distributed to it properly.

Peculiarities of Fibrous Tissue.

Is dense connective tissue.

Peculiarities of Elastic Tissue.

It curls when cut—The broad variety presents holes and forms the fenestrated membranes—It has no capillaries.

14 **Peculiarities of Adipose Tissue.**

It presents fat cells in meshes of connective tissue—It has capillaries; they form a network around each fat lobule.

15 **Peculiarities of Glandular Tissue.**

The *Racemose Glands* are found in a general way on the skin and on the mucous membranes.—The capillaries are peculiar.

In *Resumé*, the following are racemose glands:—Glands of the mucous membrane of the intestinal tract from the lips to the cardia, but not further, except the duodenal gland—The Salivary Glands are compound glands—The Liver.—The Pancreas.—Glands of the mucous membrane of the bladder—Prostate Glands—Cowpers' Glands—Glands of the mucous membrane of the Urethra.—Glands of mucous membrane of larynx, trachea, bronchi—The Lungs are a sort of racemose glands.—The Glands of mucous membrane of the Nasal Cavities—Lachrymal Glands and Caruncula.—Glands of the Skin: the Sebaceous.

Racemose Glands present lobes, lobules and acini.

Some Racemose Glands present an *accessory gland*: parotid, pancreas, lachrymal, duodenal glands. Some have two or more excretory ducts: sublingual, pancreas, lachrymal.

The *Tubular Glands* are found in :

The mucous membrane of Digestive Tract from the Cardia to the Anus—The Kidneys are a compound branching, cæcal tubular gland.—The Testicles, also.—The Sweat Glands of the Skin are compound convoluted tubular glands.

The *Closed Follicular or Lymphoid Glands* are: the Tonsils—Isolated follicles of intestines—Peyer's Patches—Spleen—Supra-renal capsules—Thyroid Body—Thymus—Pituitary Body.

There is but one *True Follicular Gland*: the ovaries.

Some Glands have *reservoirs* on the course of their ducts: the liver has the gall-bladder, the kidneys the urinary-bladder, the testicles the seminal vesicles, the lachrymal gland has the lachrymal sac.

Some Glands have a twisted duct, Wharton's duct, cystic duct, epididymis, sweat glands.

Capillaries—In the Racemose and Follicular Varieties the capillaries form a network around the lobules—In the Tubular kind the capillaries run parallel to the tubes—On cross-section they present a radiating arrangement.

16 Guide to Describe an Organ.

(When it is desired to describe it in detail.)

- a* **Definition.** *Synonymy, Etymology, History.*
- b* **Division of the Organ** into separate portions.
- c* **Number.** Single or Double—Supernumerary organs. Absence of the organ.
- d* **Dimensions.** 1st. *Relative Size*, or size compared to that of other organs or to familiar objects. 2d. *Absolute Size*: Diameters, transverse, vertical, antero-posterior. *Calibre*.
- e* **Situation.** 1st. *General Situation*, or region it occupies. 2d. *Relative Situation*, or compared to the surrounding organs.
- f* **Direction.** 1st. Compared with *axis of the body*. 2d. Compared with *its own axis*.
- g* **Means of Fixity.** Vascular connections, adhesions, ligaments; supported by other organs.
- h* **Mobility.** 1st. *Intrinsic Mobility*, or mobility of the whole organ, or a part of it. 2d. *Extrinsic Mobility*, or mobility communicated by other organs. 3d. *Extent of Mobility*. 4th. *Exceptional Mobility*.
- i* **Shape.** 1st. Compared to a geometrical figure. 2d. Compared to the shape of a familiarly known object.
- j* **Surfaces:**
 - Synonymy.*
 - Direction:* forwards or backwards, above or below, intermediate direction.

Shape: plane, concave or convex in the vertical or transverse direction.

Peculiarities: projections (folds, processes, ridges or crests, tubercles, protuberances)—depressions, orifices (size, shape, boundaries, structure, contents), blind foramina—grooves and canals (depth, extent, contents, vessels, or nerves or organs). *When enumerating peculiarities,* begin on the median line and then on the sides; proceed from before backwards, or from within outwards, or from above downwards.

Relations: With skin (*i. e.* to that part of the surface it corresponds) or with bones, joints, muscles, viscera, vessels and nerves.

k Borders:

Synonymy.

Dimensions.

Directions: 1st. *Relative Direction*, vertical, horizontal, oblique, forwards or backwards, or above or below, or inwards or outwards. 2d. *Absolute Direction*, straight, sinuous, concave or convex.

Shape: Blunt or sharp, or beveled at the expense of one surface or the other.

Peculiarities, } as for surfaces.
Relations, }

All *Thick Borders* ought to be subdivided into *two edges* or *lips* and an *interstice*. Give for each: peculiarities, insertions and relations.

l Angles or Extremities: same as borders.

Base and Apex: same also.

m Structure:

Color.

Consistency: Density, Friability, Elasticity, Retractility.

Envelopes or Coats: Thickness, Resistance, Elasticity, External Surface (relations, adhesions). Internal surface (relations, adhesions, processes from internal surface, reflection into the interior of the organ). Stroma: is delicate or apparent; is composed of connective tissue, or elastic, or smooth muscular fibres.

Proper or Characteristic Elements: Cells, Tubes, Fibres, Prisms.

Vessels: Capillaries, Arteries, Veins, Lymphatics.

Nerves.

Excretory Duct of a Gland (as a separate organ).

Lining Membrane of a Hollow Organ: Thickness, Consistency, Elasticity, Adherent Surface (degree of adhesion); Free Surface: color, peculiarities, epithelium, glands.

n Chemical Composition: Organic, Inorganic Elements.

o Development or Anatomy of the Ages.

p Peculiarities or Varieties, or Anomalies due to Sex, Habits, Trades, Constitutions, Individualities, Nationalities, Races.

RESUMÉ OF THE DIGESTIVE ORGANS.

- 17 **Enumeration.** The organs concerned in digestion are the lips, the cheeks, the vestibule, teeth, tongue, hard and soft palates, tonsils, parotid, submaxillary and sublingual glands; the pharynx, œsophagus, stomach, duodenum, jejunum, ileum, cæcal appendix, cæcum, ascending colon, transverse colon, descending colon, sigmoid flexure, rectum, anus, liver, pancreas and spleen.

LIPS.

- 18 **Structure.** The lips are composed:—1st, of a *Cutaneous layer*;—2d, of a *muscular layer* formed principally of the orbicular muscle, closely attached to the skin;—3d, of a *cellulo-glandular layer* formed of loose areolar tissue and simple racemose glands;—the *labial artery* runs through the layer;—4th, of a *mucous layer*.

N. B.—The *lymphatics* of the median line of the lower lip discharge into the digastric glands—and the other lymphatics of both lips discharge into the submaxillary lymphatic glands.

CHEEKS.

- 19 **Structure.** The cheeks are formed:—1st, of a *Cutaneous layer*;—2d, of an *adipose layer* represented specially by a little mass of fat situated between the buccinator and the masseter;—3d, of a *muscular layer*, formed posteriorly by the masseter and anteriorly by the buccinator pierced by Steno's duct;—4th, of a *glandular layer*, represented by a small group of simple racemose glands, called the *molar glands*, and clustered on the buccinator, where Steno's duct perforates it;—5th, of a *mucous layer*, which is covered with microscopic papillæ.

VESTIBULE.

- 20 **Definition.** Is the space limited in front by the lips and cheeks and behind by the teeth.

When the teeth are clinched, the vestibule communicates with the mouth proper by an *opening* limited by the last molar teeth, and the vertical branch of the inferior maxilla.

THE TEETH.

- 21 **Number.** There are two sets.—The *temporary or milk teeth* number twenty, ten for each jaw.

The *permanent* set number thirty-two, sixteen for each jaw; two central incisors, two lateral incisors, two canines, four small molars or bicuspid, six large molars or multicuspids, the last of which are called the *wisdom teeth*.

Each tooth presents a *crown*, a *neck*, a *root* or *fang*.

Shape. The *Incisors* have a cutting crown and a single root;—the *Canines* have a conical crown and a single, but long root;—the *Small Molars* have a crown presenting two points (biscupids), a single root, but broad and slightly grooved;—the *Large Molars* have a crown presenting four points (multicuspid), and from two to five roots;—the *Wisdom Tooth* has the smallest crown and presents but a single root, but it is very broad and deeply-grooved.

2 **Structure.** The *Crown* possesses two envelopes,—the *Cuticle of the Enamel*, which has no apparent structure,—and the *Enamel* itself, composed of prismatic fibres disposed in superimposed layers and having a different direction in each layer.

The *Root* has also two envelopes,—the *Alveolar Periosteum*—and the *Cement*, which resembles bony tissue, presenting cement corpuscles and canalicules.

The *Proper Substance of the Teeth* is the *Ivory* or *Dentine*;—it exists in the crown and root alike:—it is composed of canalicules extending from the cavity of the tooth to the enamel and cement.

The *Interior of the Teeth* presents a cavity containing the *Pulp of the Tooth*.—it is a projection of the alveolar periosteum,—and is composed of delicate connective tissue with capillaries and nerve fibres.

THE GUMS.

1 The *Gums* are formed of thickened mucous membrane covering the alveolar borders.

THE TONGUE.

1 **Shape.** The tongue is, at rest, triangular and flattened.

The **Base or Root** is the posterior part.

The **Apex or Tip** is the free end.

The **Under Surface** is attached along the middle of the floor of the mouth, and presents a fold of mucous membrane called the *frenum*,—on the side of which are the openings of the ducts of Wharton;—this attached portion is the *body*.

The **Upper Surface** presents the papillæ—and the glands of the mucous membrane.

1 **Structure.**

The **Mucous Membrane** presents on the anterior two-thirds the papillæ, which are the *Circumvallate* or *Calyciform*.—The *Capitate* or *Fungiform*,—and the *Conical* or *Filiform*.

They are all processes or projections of the mucous membrane and have the same structure as that membrane,—the circumvallate and the capitate present, buried in the epithelium, the *taste goblets*, which are a mode of termination of the fibrils of the gustatory nerve.

The **Muscles of the Tongue** are: the *Genio-hyoglossus*, which is the protruder;—the *Hyoglossus*, which is the depressor or retractor, or muscle which draws the tongue in;—the *Styloglossus*, which is the elevator muscle;—the *Linguals*, which make the tongue convex from before backward;—the *Palato-pharyngeus*, or constrictor of the posterior arches,—and the *Palato-glossus*, or constrictor of the anterior arches.—The tongue possesses also *Intrinsic fibres* which curve it into a gutter and give it the various other shapes it is susceptible of having.

The **Nerves of the Tongue** are the *Lingual*, from the Inferior maxillary, which is the gustatory nerve;—the *Glossopharyngeal*, which gives sensibility to the mucous membrane of the root,—and the *Hypoglossal*, which is the motor nerve of the tongue.

HARD PALATE.

- 26 **Shape and Consistency.** Some palates are deep and others are shallow.—In some the mucous membrane is soft and in others it is hard.—Both the shape and consistency are important factors in fitting plates of teeth.

Structure. The hard palate is composed,—1st, of a *Mucous layer* closely adherent to the periosteum in the anterior third of the palate;—2d, of a *Glandular layer*, composed of simple racemose glands, which are more numerous in the posterior third;—3d, of an *Osseous layer*, formed in front by the palatine process of the superior maxilla and behind by the horizontal plate of the palate bones.—*The Arteries* are the descending palatine from the internal maxillary, and the ascending palatine from the facial.

SOFT PALATE.

- 27 **Shape.** Is quadrilateral.

The **Anterior Surface** is concave, and smooth.

The **Posterior Surface** is convex and is continuous with the floor of the posterior nares.

The **Upper or Adherent Border** is attached to the posterior margin of the hard palate.

The **Lower or Free Border** presents on the *median line* the Uvula,—and on *each side* the Anterior and the Posterior Pillars of the fauces.—Between the arches are found the *Tonsils*.—The Strait or Passage between the arches of the two sides is the *Isthmus*.

- 28 **Structure.** The Soft Palate is composed from below upward:

1st. Of a *Lower mucous layer* lined with pavement epithelium.—2d. Of a *Thick layer of simple racemose glands*.—3d. Of a *Fibrous layer or fascia* attached to the bones of the hard palate.—4th. Of a *Muscular layer* composed of the Elevator of the Uvula, the Elevator of the palate, the Ten-

sor of the palate, the Constrictor of the anterior arches, the Constrictor of the posterior arches.—5th. Of a *Second thinner layer* of simple racemose glands.—6th. Of an upper mucous layer lined with columnar epithelioma.

TONSILS.

- 29 **Shape.** The Tonsils resemble an almond.
 The **Free Surface** presents a number of orifices or pouches.
 The **Deep or Adherent Surface** rests on the fascia of the pharynx—and is not far from the internal carotid artery and the apex of the parotid gland.
 The **Upper Extremity** presents above it a little recess called the *Supra-tonsillar fossa*.
 The **Lower Extremity** is separated from the base of the tongue by a tract of glands.
Structure. The tonsils are composed of an agglomeration of lymphoid follicles.

PAROTID GLANDS.

- 30 **Shape.** The Parotid gland has the shape of a flattened prism filling the cavity, called the *Parotidean Cavity*, with the base expanding externally under the skin.
 The **Anterior Surface** is in relation with the organs forming the anterior wall of the parotidean cavity, which are from outwards inwards; the ramus of the lower jaw, the external carotid artery, the internal maxillary artery and the internal pterygoid muscle.
 The **Posterior Surface** is in relation with the organs forming the posterior wall of the parotidean cavity, which are from outwards inwards; the mastoid process, the styloid process, the stylian muscles, the facial nerve, the internal jugular vein, the internal carotid artery, the glosso-pharyngeal and the hypoglossal nerves.
 The **Upper Border** is in relation with the external auditory canal and the petrous bone.
 The **Lower Border** is in relation with the posterior extremity of the submaxillary gland, from which it is separated by a fibrous septum.
 The **Apex** extends to the pharynx, to the point corresponding to the tonsil.
 The **Base** spreads on the cheek below the ear—and is covered by the skin, the platysma and superficial fascia;—its *posterior edge* rests upon the sterno-mastoid;—its *anterior edge* rests upon the masseter;—its *upper edge* is notched to accommodate the external auditory canal;—its *lower edge* extends down to near the angle of the jaw.
- 31 **Structure.** The parotid is a compound racemose gland.—The excretory duct is the *Duct of Steno*, which emerges from the anterior edge of the base, runs forward parallel to the

zygoma to the anterior border of the masseter, where it perforates the buccinator on a level with the second upper molar tooth.—Its walls are very thick and its cavity very small.

SUBMAXILLARY GLANDS.

- 32 **Shape.** The submaxillary gland has the shape of a flattened, three-sided prism.
 The **Superficial or Under Surface** is covered by the skin, platysma and cervical fascia;—the facial artery crosses its back part.
 The **External Surface** is in relation with the submaxillary fossa of the maxilla.
 The **Internal Surface** presents a process which extends backwards towards the parotid gland,—a process which extends forwards over the border of the mylo-hyoid muscle and reaches the sublingual gland.
 The **Anterior Extremity** is rounded—and is situated on the outside of the mylo-hyoid.
 The **Posterior Extremity** is separated from the parotid by a band of fascia.
- 33 **Structure.** The Submaxillary Gland is a compound racemose gland.—Its excretory duct is the *Duct of Wharton*;—it originates on the internal surface of the gland,—is directed forwards along the lingual artery and nerve—and opens on the side of the frenum at the apex of a twisted papilla.—Its walls are much thinner than those of the duct of Steno, and its cavity is much larger.

SUBLINGUAL GLANDS.

- 34 **Shape.** The sublingual glands resemble an almond.
 The **External Surface** is in relation with the mylo-hyoid muscle.
 The **Internal Surface** is in relation with the hyo-glossus and the genio-hyo-glossus muscles.
 The **Lower Border** rests on the mylo-hyoid.
 The **Upper Border** is attached to the mucous membrane, by means of its ducts;—it projects on the floor of the mouth.
 The **Posterior Extremity** extends towards the anterior process of the submaxillary gland.
 The **Anterior Extremity** is in relation with the sublingual fossa of the lower maxilla.
- 35 **Structure.** The Sublingual Gland is a racemose gland.—Its ducts are the *Ducts of Rivinus*,—about twelve in number, opening along the upper border of the gland—often several small ducts form a single one called the *Duct of Bartholin*, which opens in the duct of Wharton, or separately.

PHARYNX.

- 36 **Shape.** The pharynx is funnel-shaped.
 The **Posterior Surface** is connected by loose areolar tissue with the cervical column and its muscles.
 The **Lateral Surfaces** are in relation with the styloid process and its muscles, the internal and common carotid arteries, the jugular vein and the pneumo-gastric, glosso-pharyngeal, hypoglossal and sympathetic nerves.
 The **Anterior Surface** is incomplete,—and presents from upwards downwards; the posterior nares,—the Eustachian tubes,—the retro-Eustachian fossa—the aperture of the mouth,—the base of the tongue,—the epiglottis and its folds,—the opening of the larynx,—the two pharyngo-laryngeal grooves,—and the opening of the œsophagus.
 The **Base** corresponds to the basilar process of the occipital.
 The **Apex** is continuous with the œsophagus.
- 37 **Structure.** The pharynx is composed from without inwards:—1st, of a layer of *Areolar tissue*;—2d, of a superficial or *Muscular fascia* covering the surface of the muscles:—3d, of a *Muscular layer* composed of the superior, middle and inferior constrictor muscles, and the stylo-pharyngeus, which is the elevator muscle of the pharynx;—4th, of a *Fibrous or Aponeurotic* layer attached to the bones, which forms, as it were, the skeleton of the pharynx and which supports the muscles;—5th, of a *Glandular layer* of simple racemose glands;—6th, of a *Mucous layer*, the upper or nasal portion of which is lined with a ciliated epithelium and the balance with a pavement epithelium.

ŒSOPHAGUS.

- 38 **Dimensions.** It is narrowest at its commencement,—is also narrow opposite the fourth dorsal vertebra—and is slightly constricted where it passes through the diaphragm.
Direction: At its origin it is on the median line,—but it soon deviates a little to the left side at the root of the neck;—it then returns to the median line—and finally deviates again slightly to the left as it passes through the diaphragm.—It follows also the curvatures of the spinal column.
- 39 **Surfaces and Borders.**
In the Neck,—the *Anterior Surface* is in relation with the trachea;—the *Posterior Surface* is in relation with the vertebral column;—the *Lateral Borders* are in relation with the carotid, specially the left, the lobes of the thyroid body, the recurrent laryngeal nerve.
In the Thorax—the *Anterior Surface* is in relation with the end of the trachea, arch of aorta and pericardium; the *Posterior Surface* rests upon the vertebral column above, and below on the thoracic aorta and the thoracic duct;—the

Lateral Borders are in contact with the pleura.—The *Pneumo-gastric nerves* descend along with it.

The **Upper Extremity** is continuous with the pharynx.

The **Lower Extremity** is continuous with the stomach.

- 40 **Structure.** The œsophagus is composed:—1st, of an *External Envelope* of loose areolar tissue;—2d, of a *Muscular layer* composed of superficial longitudinal and of deep circular fibres;—they are striped fibres above and smooth below;—3d, of a *Cellulo-fibrous and Glandular layer*;—4th, of a *Mucous layer* presenting folds, papillæ and stratified epithelium.

THE CAVITY OF THE ABDOMEN.

- 41 **Shape.** The cavity of the abdomen resembles an ovoid slightly flattened from before backwards.
The **Anterior Surface or Wall** is formed by the Abdominal Straight muscles.
The **Lateral Surfaces or Walls** are formed by the Oblique and Transverse muscles.
The **Posterior Surface or Wall** is formed by the vertebral column, the pillars of the diaphragm, the upper portion of the Psoas muscles and the Square Lumbar muscles.
The **Upper Surface or Wall or Roof** is formed by the diaphragm.
The **Lower Surface or Wall or Floor** is formed by the Psoas-iliac muscles in the iliac fossa;—in the middle of the abdomen it communicates freely with the pelvic cavity.

REGIONS OF THE ABDOMEN.

- 42 **Dividing Lines.**—1st, if two *Parallel Circular Lines* are drawn round the body, the first parallel with the cartilages of the ninth ribs and the others with the highest point of the crest of the ilium, the region is divided into an upper, a middle and lower zone.—2d, if two *Perpendicular Parallel Lines* are drawn from the cartilage of the eighth ribs down to the centre of Poupart's ligament, each of the above zones is subdivided into three parts or regions, a middle and two lateral.

The middle of the upper zone in the *Epigastric Region*, or the epigastrium, and the two lateral are the right and left *Hypochondriac Regions*, or hypochondria.

The central region of the middle zone is the *Umbilical Region*, and the two lateral the right and left *Lumbar Regions* or the Loins.

The middle region of the lower zone is the *Hypogastric Region*,—and the two lateral the right and left *Iliac or Inguinal Regions*.

PARTS CONTAINED IN THE ABDOMINAL REGIONS.

- 43 **Right Hypochondriac Region.**—Liver,—gall bladder,—duodenum,—right angle of colon,—suprarenal capsule,—upper extremity of right kidney.
Epigastric Region—Liver,—stomach,—pancreas,—aorta, thoracic duct,—ascending cava vein.
Left Hypochondriac Region—Liver,—stomach,—pancreas,—spleen,—left angle of colon,—suprarenal capsule,—upper extremity of left kidney.
- 44 **Right Lumbar Region.** Coils of jejunum,—ascending colon,—lower part of right kidney.
Umbilical Region—Transverse colon,—part of great omentum,—part of mesentery,—duodenum (3d portion),—coils of jejunum.
Left Lumbar Region—Coils of jejunum,—descending colon,—lower part of left kidney.
- 45 **Right Iliac Region.** Coils of ileum,—cæcum and appendix,—ileo-cæcal valve,—ureter,—spermatic vessels.
Hypogastric Region—Coils of ileum,—bladder when distended,—uterus in pregnancy,—rectum.
Left Iliac Region—Coils of ileum,—sigmoid flexure,—ureter,—spermatic vessels.

PERITONEUM.

- 46 **Number or Divisions.** The *Parietal Peritoneum* lines the walls of the abdomen;—the *Visceral Peritoneum* covers the surface of the organs.
 There is a *General Peritoneal Cavity*,—and a *Smaller Cavity* behind the stomach enclosed in the great omentum—communicating with the general cavity through the *Foramen of Winslow*.
- 47 **Folds.** The folds or ligaments of the peritoneum connected with each organ are the following:
- 1st. *With the Stomach*; the gastro-hepatic omentum,—the gastro-splenic,—the gastro-colic or great omentum.
 - 2d. *With the Small Intestines*: the mesentery.
 - 3d. *With the Large Intestines*: the meso-cæcum,—the ascending meso-colon,—the transverse meso-colon,—the sigmoid meso-colon,—and the meso-rectum.
 - 4th. *With the Bladder*: in the male,—the recto-vesical folds and pouch,—the vesico-pubic folds and pouch.
 - 5th. *With the Uterus*: the recto-uterine folds—and Douglas' pouch,—the utero-vesical folds and pouch—and the broad ligaments.
 - 6th. *With the Liver*: the coronary ligament,—the triangular ligaments,—the suspensory ligament,—and the gastro-hepatic omentum.

48 Relations of the Viscera with the Peritoneum.

The stomach is entirely surrounded by peritoneum.

The duodenum is uncovered in its posterior surface.

The small intestines are entirely surrounded by peritoneum.

The cæcal appendix also.

The cæcum also, usually; sometimes the posterior surface is partly uncovered.

The ascending colon is deprived of peritoneum on its posterior surface.

The transverse colon is completely surrounded by peritoneum.

The descending colon is deprived of peritoneum on its posterior surface.

The first portion of the rectum is entirely surrounded by peritoneum.

The second portion is covered only in front and partly on the sides.

The third portion is entirely free of peritoneum.

The liver is deprived of peritoneum along its upper border.

The pancreas is uncovered at the posterior surface of the body and head.

The spleen is completely surrounded by peritoneum.

The supra-renal capsules are free behind.

The kidneys are uncovered in their posterior surface.

The pelvis is free behind.

The ureters are uncovered on their posterior surface all along.

The anterior surface of the bladder is uncovered when the viscus is distended.

The posterior surface is entirely covered.

The lateral surfaces are covered only on their upper and posterior parts.

The base is free from peritoneum.

The body of the uterus, the Fallopian tubes, and the ovaries are completely surrounded with peritoneum.

The anterior surface of the neck is free on its lower half.

The posterior surface is completely covered.

The anterior surface of the vagina is free.

The posterior surface is covered on its upper part near the neck.

STOMACH.**49 Shape.** The stomach is irregularly conical and bent upon itself.

The **Anterior Surface** is in relation with the liver, the abdominal walls and the diaphragm.

The **Upper Border** is concave;—it gives attachment to the gastro-hepatic omentum;—it is in relation with the Spigelian lobe of the liver.

The **Lower Border** is convex;—it gives attachment to the gastro-colic omentum;—it is in relation with the transverse colon.

The **Left Extremity** gives attachment to the gastro-splenic omentum;—it is in relation with the spleen.—It presents the œsophageal opening of *Cardia* continuous with the œsophagus without any distinct line of demarcation externally or internally.

The **Right Extremity** is the *Pylorus*;—it is in relation with the liver in front and behind with the head of the pancreas and the duodenum.—It presents the pyloric opening or the *pylorus* separated externally from the duodenum by a groove, and internally by a round prominent muscular valve, the *Pyloric Valve*.

The **Posterior Surface** is in relation with the pancreas, the aorta, the pillars of the diaphragm and the ascending cava.

- 50 **Structure.** The Stomach is composed:—1st, of a *Serous* coat, formed by the peritoneum reduced to its endothelial layer;—2d, of a layer of *Longitudinal Muscular* fibres formed by the expansion of the fibres of the œsophagus and of the duodenum;—3d, of a layer of *Circular Fibres*;—4th, of a layer of *Oblique Fibres*;—5th, of a *Submucous layer of Fibro-Avolar* tissue;—6th, of a *Mucous Coat* which presents the *Hexagonal crests and depressions*—and the openings of the glands;—these glands are the *Pyloric* or *Mucous Tubular Glands*—and the *Cardiac* or *Peptic Tubular Glands*,—these presenting peculiar large cells, the *peptic cells*.

The layers are much thinner in the left half of the stomach than in the right half.

DUODENUM.

- 51 **Shape.** The duodenum resembles an irregularly shaped horseshoe or crescent.

The **Anterior Surface** is in relation with the stomach.

The **External or Convex Border** is in relation with the ascending colon.

The **Internal or Concave Border** is in relation with the head of the pancreas, the common bile duct and pancreatic ducts.

The **Upper or Gastric Extremity** is separated from the stomach by a groove externally—and internally by the pyloric valve.

The **Lower or Jejunal Extremity** is continuous with the jejunum without any line of demarcation;—the superior mesenteric artery is the limit between the two.

The **Posterior Surface** is in relation with the pillar of the diaphragm, the ascending cava, the supra-renal capsule and kidney.

- 52 **Structure.** The Duodenum is the *thickest and largest portion* of the small intestines.

It is composed,—1st, of a *Serous Coat* formed by the peritoneum reduced to its endothelial layer;—2d, of a *Layer of*

Longitudinal Fibres;—3d, of a layer of *Circular Fibres*;—4th, of a *Submucous Fibro-Areolar Layer*;—5th, of a *Mucous Coat* which presents—the openings of the bile and pancreatic ducts,—large and numerous *valvulæ conniventes*—with crest-like villi,—tubular glands—and mucous glands (glands of Brunner).

The Villi are projections of the mucous membrane,—presenting an epithelial layer of columnar cells—a stroma of connective tissue and smooth muscular fibres,—a cavity in the centre, occupied by a *cæcal lacteal* vessel.

JEJUNUM.

53 **Shape.** The Jejunum resembles a cylindrical and convoluted tube,—forming a sort of square or cubical mass.

The **Anterior Surface** of this mass is in relation with the great omentum and the umbilical abdominal walls.

The **Upper Surface** is in relation with the transverse colon—and stomach.

The **Under Surface** is in relation with the coils of the ileum.

The **Right Surface** is in relation with the walls of the lumbar region and the ascending colon.

The **Left Surface** is in relation with the walls of the lumbar region and the descending colon.

The **Upper Extremity** is separated from the duodenum by the superior mesenteric artery.

The **Lower Extremity** is continuous with the ileum by any line of demarcation;—the upper two-fifths form the jejunum.

The **Posterior Surface** is attached by the mesentery to the vertebral column, aorta, pylorus, the diaphragm and ascending cava vein.

54 **Structure.** The structure of the jejunum is the same as that of the duodenum,—except that it is not quite so thick,—the *valvulæ conniventes* are more numerous,—the villi are exclusively conical,—the glands are exclusively tubular (Lieberkuhn) and follicular (isolated).

ILEUM.

55 **Shape.** The shape of the ileum is that of a much dilated cylindrical tube—forming a sort of square or cubical mass.

The **Anterior Surface** of this mass is in relation with the hypogastric abdominal walls.

The **Right Surface** is in relation with the walls of the iliac region, the cæcum, the iliac and the psoas muscles, external and internal iliac vessels.

The **Left Surface** is in relation with the walls of the left iliac region, the sigmoid flexure, the iliac and the psoas muscles, and the external and internal iliac vessels.

The **Upper Surface** is in relation with the coils of the jejunum.

The **Under Surface** dips into the pelvis — and is in relation with the bladder, rectum and uterus.

The **Upper Extremity** is continuous with the jejunum, without any apparent line of demarcation;—the lower three-fifths form the ileum.

The **Lower Extremity** opens into the cæcum and presents the *Ileo-cæcal Valve*,—which has the shape of a buttonhole — and presents an upper and lower flap.

The **Posterior Surface** is in relation with the lumbar and sacral columns, the aorta, thoracic duct and ascending cava.

- 56 **Structure.** The ileum has the same structure as the jejunum,—except that it is *much thinner*;—*the valvule*—and *villi* are smaller, fewer and farther between;—it is provided with *tubular glands* and *isolated follicles*.

It alone possesses the *Agminated Follicles* or *Peyer's Patches*,—which occupy the free border of the intestines— and which are larger and the more numerous as we approach the ileo-cæcal valve.

CÆCAL APPENDIX.

- 57 **Shape.** The cæcal appendix resembles a goose-quill. The **Surfaces** are smoother — and are in relation with the iliac fossa and the end of the ileum.

The **Lower Extremity** is closed.

The **Upper Extremity** opens into the cæcum — and is guarded by a valve.

Structure. It is composed:—1st, of an external *Serous Layer*;— 2d, of a layer of *Longitudinal Smooth Muscular* fibres, uniformly distributed all around it;—3d, of a layer of *Circular Fibres*;—4th, of a *Mucous Coat* with tubular glands.

CÆCUM.

- 58 **Shape.** The cæcum is cuboidal. The **Anterior Surface** is sacculated,—as are all the others; —it is in relation with the coils of the ileum and the walls of the inguinal region.

The **External Surface** is in relation with the transverse and oblique muscles and the crest of the ileum.

The **Internal Surface** is in relation with the ileo-cæcal valve, the terminal coil of the ileum and the cæcal appendix.

The **Apex** communicates with the cæcal appendix.

The **Base** is continuous with the ascending colon without any line of demarcation, except the ileo-cæcal valve.

The **Posterior Surface** gives attachment to the meso-cæcum;—it is in relation with the iliac muscle.

- 59 **Structure.** The cæcum is composed: 1st, of an incomplete *Peritoneal* coat;—2d, of a layer of *Longitudinal Muscular* fibres gathered into three bandelettes;—3d, of a layer of *Circular Fibres*;—4th, of a *Submucous Fibro-Areolar Layer*;—5th, of a *Mucous Layer*—presenting *sacculæ* and *ridges*,—it possesses *tubular glands* and *isolated follicles*.

ASCENDING COLON.

- 60 **Shape.** The ascending colon is cuboidal.
 The **Anterior Surface** is sacculated,—as are also the others;—it is in relation with the coils of the intestines and the under surface of the liver.
 The **External Surface** is in relation with the transverse and oblique muscles.
 The **Internal Surface** is in relation with the small intestines.
 The **Lower Extremity** is continuous with the cæcum,—from which it is separated by the ileo-cæcal valve.
 The **Upper Extremity** forms the *right angle* or bend—which separates it from the transverse colon;—it is in relation with the under surface of the right lobe of the liver.
 The **Posterior Surface** is in relation with the iliac crest, the square lumbar muscle, the kidney and supra-renal capsule.
Structure. The ascending colon has the same structure as the cæcum.

TRANSVERSE COLON.

- 61 **Shape.** The transverse colon is cuboidal.
 The **Anterior Surface** is sacculated—and so are the others;—it is in relation with the liver, the abdominal walls, the gastro-colic omentum and the diaphragm in the left hypochondrium.
 The **Upper Surface** is in relation with the stomach and liver.
 The **Under Surface** is in relation with the small intestines.
 The **Right Extremity** is separated from the ascending colon by the *right angle* or bend of the colon.
 The **Left Extremity** is separated from the descending colon by the *left angle* or bend of the colon;—it is in relation with the spleen and supra-renal capsule.
 The **Posterior Surface** gives attachment to the transverse meso-colon.
Structure. The transverse colon has the same structure as the ascending colon and cæcum.

DESCENDING COLON.

- 62 **Shape.** The descending colon is cuboidal.
 The **Anterior Surface** is sacculated like the others;—it is in relation with the peritoneum, the diaphragm, the small intestines and the abdominal walls.
 The **External Surface** is in relation with the transverse and oblique muscles.
 The **Internal Surface** is in relation with the small intestines.
 The **Upper Extremity** is separated from the transverse colon by the left angle of the colon;—it is in relation with the spleen.
 The **Lower Extremity** is continuous with the sigmoid flexure without any line of demarcation except the difference in the direction of the organs;—the crest of the ileum is considered the line between the two.
 The **Posterior Surface** is in relation with the supra-renal capsule, the kidney and square lumbar muscle.
Structure. The Descending Colon has the same structure as the other colons and the cæcum.

SIGMOID FLEXURE.

- 63 **Shape.** The sigmoid flexure is cylindrical and forms an italic *S*.
 The **Anterior Surface** is in relation with the abdominal walls and the intestinal coils.
 The **Upper Extremity** is continuous with the descending colon without any line of demarcation,—the limit between them being the crest of the ileum.
 The **Lower Extremity** is continuous with the rectum without any line of demarcation;—the sacro-iliac articulation is considered the boundary between the two.
 The **Posterior Surface** gives attachment to the sigmoid meso-colon.
- 64 **Structure.** The sigmoid flexure is twice as thick as the colon. It is composed:—1st, of a *Peritoneal Coat* which usually invests it completely;—2d, of a layer of *Longitudinal Muscular Fibres* which are still disposed in bandelettes, but closer to one another than in the colons;—3d, of a layer of *Circular Fibres*;—4th, of a *Submucous Fibro-Areolar Layer*;—5th, of a *Mucous Coat* presenting irregular folds,—having tubular glands and isolated closed follicles.

RECTUM.

- 65 **Shape.** The rectum is cylindrical,—but is not convoluted.
Lateral Surfaces are in relation with the pelvic areolar tissue.
 The **Anterior Surface** is concave;—it is in relation *in the*

male with the bladder, prostate and seminal vesicles;—in the *female* it is in relation with the uterus and vagina.

The **Posterior Surface** is convex;—it is in relation with the sacrum and coccyx.

The **Upper Extremity** is continuous with the sigmoid flexure.

The **Lower Extremity** is continuous with the anus;—the upper edge of the strong internal sphincter is the limit between the two.

- 66 **Structure.** The rectum is the thickest portion of the intestinal tract. It is composed:—1st, of a *Serous Coat* which invests it completely only in the upper third;—the last third is deprived of it entirely;—2d, of a layer of *Longitudinal Muscular fibres* surrounding all the bowel;—3d, of a layer of *Circular Fibres*, a portion of which forms the internal sphincter;—4th, of a layer of *Submucous Fibro-Areolar Tissue*;—5th, of a *Mucous Layer* provided with numerous tubular glands and isolated follicles.

ANUS.

- 67 **Shape.** The anus has the form of a circular ring about one inch in height.

The **Lateral Surfaces** are in relation with the cellulo-adipose tissue of the ischio-rectal fossæ.

The **Anterior Surface** is in relation with the perineum.

The **Posterior Surface** is in relation with the coccyx, to which it is attached.

The **Upper Extremity** is continuous with the rectum and forms an angle with it;—the strong edge of the internal sphincter is the limit.

The **Lower Extremity** is continuous with the skin.

- 68 **Structure.** The anus is composed:—1st, of a layer of *Striped Circular Fibres* forming the external sphincter;—2d, of a layer of *Submucous Fibro-Areolar Tissue*;—3d, of a *Muco-Cutaneous Layer* presenting *pouch-like* depressions separated by small *pillars*;—it is provided with tubular glands and sebaceous glands.

PECULIARITIES OF THE DIGESTIVE TRACT.

- 69 **Guide.** Follow Shape, Surfaces, Borders, Extremities, Structure, Vessels, Nerves, and say what peculiarities each presents, if any.

Peculiarities of the Lips.

The Epithelium is stratified, *i. e.*, is in many layers throughout.—It is pavement from the lips down to the cardiac orifice of the œsophagus.—It is columnar from the cardia down to the anus.

All the Glands are racemose to the cardiac orifice of the

œsophagus.—Beyond there are no racemose glands in its walls except the glands of Brunner in the Duodenum.—Tubular Glands exist from the cardia to the anus.

All the Muscular Fibres are striped down to the middle of the œsophagus.—They are all smooth below that point down to the anus exclusively.

The Submucous Fibro-Areolar layer is loose from the lips to the anus, except over the gums and first part of hard palate.

The Mucous Membrane presents microscopic papillæ down to the cardia.

The Nerves almost all take support on the arteries to reach the organs.

The cutaneous and the muscular layers are blended together.

The Muscle is an orbicular and is the only thoroughly cutaneous muscle.

The Glandular layer is submucous and is thick.

The Mucous layer and the skin come in contact.

The Epithelium is pavement.

The Arteries strike the lips at the commissures.—They are parallel to the lips.—They are in the glandular layer.

The Veins of the upper lip open into the facial, which inculcates with the Ophthalmic.

The Lymphatics of the middle of the lower lip open separately in the digastric glands.

Peculiarities of the Cheeks.

There is a small adipose mass between the masseter and the buccinator which is always present.

The glandular layer is represented by the few small molar glands situated around the part where Steno's duct perforates the buccinator.

The Buccinator is perforated by a duct (the only instance for a muscle).

The Submucous layer has no glands.

The Mucous membrane presents the orifice of Steno's duct at the level of the second upper molar tooth.

70 **Peculiarities of the Teeth.**

They present two sets: a temporary and a permanent set. No other region presents this feature of changement—The Wisdom Tooth comes out at about twenty.

The Enamel corresponds to the epidermis of the skin—The Cement corresponds to the bony tissue.—The Dentine corresponds to the canalicules of bones and of the cornea.

The Pulp corresponds to the hair papilla.

Peculiarities of the Gums.

The Mucous Membrane is remarkable for its adhesion to the periosteum (as in the hard palate).

71 **Peculiarities of the Tongue.**

The Frenum presents the openings of Wharton's Ducts.—The Papillæ are unique.—Papillæ are found also in the

skin.—Microscopic papillæ are found in the mucous membrane of the lips down to the cardia.—They resemble the villi; but these differ in containing in their interior a lymphatic vessel.

The Ranine Arteries are dangerously large beyond the anterior half

The Ranine Veins are seen by transparency through the mucous membrane.

The Capillaries of the papillæ are peculiar and characteristic: they are poplar-like in the conical and oak-like in the fungiform.

The Nerves are of three kinds:—The Gustatory is the nerve of special sense; it comes from an ordinary nerve, the inferior maxillary, a unique instance. It terminates in the taste-goblets.

The Glosso-pharyngeal supplies ordinary sensibility to the back part of the tongue mostly.

The Hypoglossal is the motor nerve.

The tongue is the only muscle which presents intrinsic fibres, *i. e.*, fibres originating and terminating in it.

72 Peculiarities of the Hard Palate.

It presents the mucous papillæ and the transverse ridges.

The Mucous Membrane is closely adherent to the periosteum in front.—Behind it is separated by a thick granular layer.

The Artery is in the groove between the alveolar process and the palatine process.

Peculiarities of the Soft Palate.

It is a single flap valve, a musculo-membranous valve (unique case).

Its floating position is remarkable.

Its group of muscles is also noticeable: elevators, tensors, etc.

It has a double layer of racemose glands.

The epithelium, situated on the upper surface, is ciliated.

Its nerves come from a ganglion (Meckel's).

73 Peculiarities of the Tonsils.

The depressions of the surface are noticeable.

The presence of the tonsils in the pharynx is remarkable.

They are the first lymphoid follicles met on the digestive tract.

The Deep Surface corresponds to the Internal Carotid Artery.

It receives from the Pharyngeal (external carotid) a tonsillar branch which, in chronic inflammation, becomes large and adherent to the tissue, hence hemorrhage when sectioned.

Peculiarities of the Parotid.

It is the largest of the three salivary glands.

Its base, expanded on the cheek, is but a small part of it.

Its body is deeply seated between the ear and the jaw.

It extends to the pharynx.

It is in relation with numerous large vessels, nerves.—The carotid, temporal, internal maxillary, behind the condyle.—The Facial nerve crosses the outer portion of it.—The Internal Jugular, Internal Carotid, the Pneumo-gastric, Hypoglossal, Spinal Accessory correspond to its posterior surface near the apex.

Its Duct, Steno's Duct, perforates a muscle, the buccinator (a unique case).—It has thick walls and a small bore.—It runs parallel to the zygoma, but one-quarter inch below.

74 Peculiarities of the Submaxillary Gland.

It is outside the month.—It fills the digastric triangle.—Its posterior extremity is crossed by the facial artery.

Its duct, Wharton's Duct, is inside the mouth.—Its walls are thin and the bore large.—It opens by a twisted papilla on each side of the frenum.

Its nerves come from the chord of the tympanum, which, when cut, increases the secretion of the gland.

Peculiarities of the Sublingual Gland.

It is inside the mouth, whereas the other salivary glands are on the outside.

It is the smallest of all the salivary glands.

It raises the mucous membrane of the floor of the mouth.

It is mobile.

It has several separate ducts, the Ducts of Rivinus and the Ducts of Bartholin.

Nerves: Same as for submaxillary.

75 Peculiarities of the Pharynx.

It is truly the beginning of the intestinal tract.

Its upper portion is fixed — the middle and lower portions are movable.

It is closed above and behind — it is open in front and below — it communicates with the ear, the nasal cavities, the mouth, the larynx, the œsophagus.

It is at the same time part of the respiratory tract and of the digestive tract.

Its Lateral Surfaces are in relation with large vessels and nerves.

It presents the first circular and longitudinal fibres — it presents the last fibres with bony origin or insertion.

It presents a thick layer of racemose glands.

The Epithelium of the upper third is ciliated; in the other portions it is pavement.

It presents a thick fibrous layer.

76 Peculiarities of the Œsophagus.

Its length is remarkable, extending from the pharynx to the stomach, because of the heart intervening between the pharynx and stomach.

Its shape is also peculiar.

Its calibre also; it is narrowest at its beginning, is narrow

also opposite the fourth dorsal vertebra and is slightly constricted when it passes through the diaphragm.

Its direction is peculiar; at its origin it is on the median line.—It soon deviates to the left side at the root of the neck.—It then returns to the median line.—It finally deviates again slightly to the left as it passes through the diaphragm.—It follows also the curvatures of the spinal column.

Its relations are numerous and important; trachea, aorta, carotids, recurrent laryngeal nerve, pericardium, thoracic duct and pleura.—The pneumo-gastric nerves take support on it to reach the stomach.

Its lower extremity presents no line of demarcation for the stomach.

Its structure is peculiar in this, that the muscular fibres are smooth below its middle portion.

77 **Peculiarities of the Cavity of the Abdomen.**

It is the largest of all the cavities of the body.

Most of its walls are soft and movable.

Almost all of the largest and of the solid organs are in the upper part.

It contains a great number of various organs, whereas other cavities contain but few.

Peculiarities of the Peritoneum.

It is the largest of all the serous cavities.

It presents a smaller cavity, with the foramen of Winslow, which no other presents.

It presents a great number of folds called mesos.

It alone presents such folds as the Great Omentum and the Mesentery.

78 **Peculiarities of the Stomach.**

Its size varies more than that of any other organ.

Its shape is peculiar and unique, that of a cone bent upon itself.

The situation it occupies is remarkable, three regions, and it extends from the surface to the deep parts.

It presents a distinct line of demarcation between it and the duodenum.

It presents three distinct layers of muscular fibres, whereas the other organs present only two.

It presents the peculiar pyloric valve, a sphincter valve.

The mucous membrane presents the peculiar hexagonal spaces and the peculiar peptic glands.

It is surrounded by a circle of arteries.

Its veins form the portal system; also all the veins of the intestines and the spleen.

Its nerves come from the pneumo-gastric, one situated along its upper border and the other on the posterior surface.

79 **Peculiarities of the Duodenum.**

Its shape is peculiar, that of an irregular crescent.

Its fixity is noticeable, whereas the small intestines are very movable.

Its deep situation is peculiar, for all the small intestines are superficial.

It is deprived of a line of demarcation from the jejunum.

It is the thickest and the largest portion of all the small intestines.

It presents the Large Papilla containing the openings of two large ducts, the Common Bile Duct, and the Pancreatic.

It presents also the Small Papilla corresponding to the Lesser Pancreatic Duct.

It presents Valvulæ Conniventes found nowhere else except in the small intestines.

It presents Villi which are not found outside of the small intestines.—Its Villi are crest-like.—Their capillaries are under the epithelium, in the stroma.—A Villus is characterized by having a dilated lacteal in its centre.

It has peculiar racemose glands, the Glands of Brunner.

80 **Peculiarities of the Jejunum.**

The mobility of its coils is remarkable.

It is superficially situated.

It occupies the umbilical and the two lumbar regions.

It presents no line of demarcation from the duodenum or from the ileum.

Its Valvulæ Conniventes are more numerous.—The Villi are conical.—It presents scattered Isolated Closed Follicles. These are henceforth found down to the anus.

It receives its arterial supply from one source alone—the Superior Mesenteric, as also the ileum.

The lymphatics are called the *lacteals*, down to the anus.

Its Nerves come from the sympathetic and reach it by taking support on the arteries.—The same applies to the rest of the intestines, small and large.

Peculiarities of the Ileum.

It occupies the lower part of the abdomen.—It dips down into the pelvis.—It usually leaves the cæcum and the sigmoid flexure uncovered.—It also is superficially situated.

The mobility of its coils is also great.

It presents no line of demarcation from the jejunum.

It is separated from the larger intestines by the ileo-cæcal valve.

Its walls are thinner than at any other point of the small intestines.

The Valvulæ are smaller, fewer and further apart.

The Villi are also less numerous.

The Isolated Closed Follicles are more numerous.

It alone presents the peculiar Peyer's patches.—These patches are all situated on the convex border of the small intestines.—They are larger and more numerous as we come nearer the ileo-cæcal valve.

81 Peculiarities of the Ileo-cæcal Valve.

It is a double-flap muco-membranous valve. (In the heart the double-flap valves are purely fibrous.)—It contains few smooth muscular fibres.

It opens readily to fluids coming from the ileum, but closes against fluids coming from the large intestines.

Peculiarities of the Cæcal Appendix.

It is unique.—Abnormally we sometimes find similar diverticles on the course of the intestines.

Its situation is noticeable, behind the ileo-cæcal valve.

It is often twisted.

Its cæcal extremity is closed by the effective valve of Morgagni.

It often contains seeds and foreign bodies.—It is the initial point of appendicitis.

Its walls are thick.—The muscular fibres are uniformly distributed around it.—It possesses only tubular glands.

82 Peculiarities of the Cæcum.

Its dimensions are short.

Its shape is noticeable; it is cuboidal and is sacculated, as is the balance of the large intestines down to the rectum.

It is usually superficially seated.

It receives the opening of the cæcal appendix and the ileo-cæcal valve.

Its walls are thin.

The longitudinal muscular fibres are arranged in bandel-ettes.

The mucous layer presents ridges and sacculæ.

It possesses only tubular glands and isolated follicles.

It receives its arterial supply from the Superior Mesenteric.

Peculiarities of the Ascending Colon.

Is deeply seated, behind the coils of the jejunum.

It is fixed in its position.

The Posterior Surface is deprived of peritoneum.

It is in relation in front with the liver and the right kidney.

It presents a separation from the cæcum, the ileo-cæcal valve.

It is separated from the transverse colon by an angle.

Peculiarities of the Transverse Colon.

It is superficially seated.

It corresponds to the line between the epigastrium and the umbilical region.

It is very movable, possessing a long fold of the peritoneum, the transverse meso-colon.

It is in relation with the liver, stomach, pancreas, spleen, small intestines.

It presents the right and the left bends.

The right half is supplied by the Superior Mesenteric artery and the left by the Inferior Mesenteric.

Peculiarities of the Descending Colon.

It is deeply seated, behind the coils of the jejunum.

It is fixed in its position.

The Posterior Surface is deprived of peritoneum.

It is in relation with the spleen and left kidney.

It presents no separation from the sigmoid flexure.

83 Peculiarities of the Sigmoid Flexure.

It is superficially seated, usually uncovered by the coils of the ileum.—It is movable.—Sometimes it is found in the pelvis.

Its shape is peculiar, that of an italic *S*.

It presents no line separating it from the colon and rectum.

The mucous membrane presents only tubular glands and closed follicles.

Peculiarities of the Rectum.

Is so called because it is more straight than the coils of the smaller intestines.

It is sometimes very large.

It presents a lateral curve and an anterior one.

It is deeply seated.

The upper third is completely surrounded by peritoneum.—The middle third only in front and on the sides.—The lower third not at all.

It is in relation with the bladder, prostate, seminal vessels, spermatic ducts, ureters;—in the female with the uterus and vagina.

It presents no line of separation from the sigmoid flexure.

It is separated from the anus by the strong edge of the sphincter and by a change of direction.

The muscular fibres are stronger than anywhere else.—They are uniformly distributed all around.—The circular fibres form the Internal Sphincter (like the pyloric valve).

The Submucous layer is very thick.

The Mucous membrane is thicker.

The Tubular Glands and the Isolated Closed Follicles are more numerous.

The Arteries are the three hemorrhoidals; the superior are the most important.

The nerves come from the hypogastric plexus.

84 Peculiarities of the Anus.

Its height, one inch, is remarkable.

Its shape, a ring, is noticeable.

The relations of the lateral surfaces with the adipose tissue of the ischio-rectal fossæ is important surgically.

It is separated from the rectum by the strong edge of the sphincter muscle.

The lower extremity is continuous with the skin, the second instance of a mucous membrane continuous with a cutaneous membrane.

The attachment of the sphincter to the coccyx and to the perineal muscles are important surgically.

The Muco-cutaneous layer presents peculiar pouches and pillars.—It presents tubular glands on the mucous portion.—It presents sebaceous glands on the cutaneous portion.

The Veins are the farthest radicles of the portal system.

The Lymphatics of the mucous portion open in the pelvic glands.—Those of the cutaneous portion in the inner inguinal glands.

The Nerves are numerous and very sensitive: these reflexes are the last abolished in anesthesia.

85 **Peculiarities and Characteristics of the Mucous Membrane Alone of the Digestive Tract.**

Guide: Mention first peculiarities (projections or depressions), then peculiarities of epithelium and glands, if any.
Epithelium.

It is stratified or laminated, *i. e.*, is in many layers throughout the whole length.

It is pavement from the lips down to the cardia (except in the nasal portion of the pharynx, where it is ciliated).

It is columnar from the cardia down to the anus.

Microscopic Papillæ, similar to those of the skin, exist from the lips to the cardia.

Glands: All the glands are Racemose from the lips to the cardia.

All the glands are Tubular from the cardia to the anus (except the Brunner Racemose Glands of the duodenum).

Lips: The glands form a thick submucous layer.

Cheeks: Present the opening of Steno's Duct, opposite the upper second molar.

The *Glands* are the peculiar Molar Glands and the opening of Steno's Duct, on the outer surface of the buccinator.—There is no submucous layer of glands.

Gums: The mucous membrane adheres closely to the periosteum.

They have no glands.

Tongue: It presents on the Dorsal aspect the Papillæ.

Glands do not exist where the papillæ are; they exist only on the posterior third.

On the Under Surface the mucous membrane shows the ranine veins.

Also the opening of the Ducts of Wharton, of Rivinus, of Bartholin.

Hard Palate: It presents the Incisor Papilla.—Also transverse ridges.

It adheres to the periosteum in front but is loose behind.

Soft Palate: The Epithelium is situated on the upper surface.

The Glands form a double layer.

Tonsils: They present depressions or pouches.

The proper element of the tonsils are closed lymphoid follicles.

Pharynx: The glands are large and prominent.

Œsophagus: Presents nothing characteristic, except the very absence of characteristics.

86 **Stomach:** It presents the hexagonal spaces.

It presents the peculiar Cardiac Tubular Peptic Glands.

Duodenum: Presents the Large and the Small Papillæ.

Also the Valvulæ Conniventes.

Also the Villi, which are crest-like.—The Villi are characterized by a central lacteal vessel.

It presents also the peculiar Racemose Glands of Brunner.

Jejunum: The Valvulæ Conniventes are more numerous.

The Villi are conical.

It presents few Isolated Closed Follicles.—These follicles extend from this point to the anus.

Ileum: The Valvulæ Conniventes are fewer and further between and are very scarce and small near the ileo-cæcal valve.

The Isolated Follicles are more numerous.

Here we find the Peyer's Patches described above.

Cæcal Appendix: Presents no closed follicles.

Cæcum, Colons, Sigmoid Flexure: They present crests and sacculæ.

Isolated follicles are not very numerous.

Rectum: The membrane is thick.

The glands are numerous.

The submucous areolar tissue is abundant and binds the membrane loosely to the muscular coat.

Anus: The membrane is thick.—It presents the pouches and pillars.

The Glands on the cutaneous portion are sebaceous.

LIVER.

87 **Shape.** The liver resembles the half of an ovoid.

The **Upper Surface** is convex;—it gives attachment to the suspensory ligament;—it is in relation with the diaphragm and the abdominal walls.

The **Upper or Posterior Border** presents a notch for the ascending cava vein;—it gives attachment to the coronary and lateral ligaments;—it is in relation with the aponeurotic diaphragm.

The **Lower or Anterior Border** is thin;—it presents a notch for the round ligament and one for the gall bladder; it is in relation with the edge of the costal cartilages and the abdominal walls.

- 88 The **Right Extremity** is thick— and is in relation with the diaphragm and kidney.

The **Left Extremity** is thin— and is in relation with the spleen.

The **Under Surface** is concave.

The *Middle Region* presents: 1st, the transverse fissure lodging the gastro-hepatic omentum, the hepatic artery, portal vein, left pneumo-gastric nerve, the hepatic ducts, lymphatic vessels and glands;— 2d, the fissure for the round ligament;— 3d, the fissure for the ascending cava vein;— 4th, the fissure for the ductus venosus;— 5th, the fossa for the gall bladder;— 6th, the Spigelian and caudate lobes, corresponding to the upper border of the stomach;— 7th, square lobe.

The *Right Region* is in relation with the angle of the colon, the right supra-renal capsule and kidney.

The *Left Region* is in relation with the left extremity of the stomach and spleen.

89. **Structure.** 1st: The liver has *Two Envelopes*,—a *Serous* or *Peritoneal* endothelial layer—and a *Fibrous Layer* reflected at the hilus into the interior of the organ and called the *Capsule of Glisson*;— 2d, the *Proper Tissue* is composed of alveoles filled with the *proper hepatic cells* and forming the hepatic *lobules*;— 3d, the *Portal Vein* and the *Hepatic Artery* form a plexus around each lobule and send into the interior of the lobule separate branches which become the radicles of the *Capillary Hepatic Vein* or *Intralobular Vein*, which occupies the *centre* of the lobule;— the trunks of the hepatic veins open into the ascending cava along the upper border of the liver;— 4th, the *Capillary Bile Radicles* originate in the lobules by dilated extremities, which according to some are surrounded by hepatic cells, whereas, according to the author, they are lined by the hepatic cells.

Excretory Apparatus of the Liver. The capillary bile radicles unite to form the *Bile Ducts* which unite in the transverse fissure to form the *Hepatic Duct*. This duct receives the *Cystic Duct* from a reservoir called the *Gall bladder* and the two form the *Common Bile Duct*.—This descends into the groove between the duodenum and pancreas where it is joined by the main pancreatic duct and opens into the duodenum at the apex of the *Large Papilla*.—**Structure.** The large ducts and the gall bladder are composed of an external fibrous coat, of a middle fibro-elastic and muscular coat and of an internal mucous coat.—They present in their walls a large number of *microscopic racemose glands*.

PANCREAS.

- 90 **Shape.** The pancreas resembles a hammer with its handle. The **Anterior Surface** presents grooves and lobules and so do the other surfaces;—it is in relation with the stomach.

The **Upper Border** is grooved for the splenic vein; the splenic artery is above the vein.

The **Lower Border** presents a notch for the superior mesenteric artery.

The **Right Extremity or Head** is separated from the body by a neck;—it is embraced by the duodenum.

The **Left Extremity or Tail** is in relation with the spleen. The **Posterior Surface** is in relation with the aorta and the pillars of the diaphragm, the ascending cava vein and the vertebral column.

- 91 **Structure.** The pancreas is a compound racemose gland. The *Main Duct* or Duct of Wirsung comes from the body, joins the common bile duct and opens into the duodenum. The *Lesser Duct* comes from the head and opens often separately into the duodenum above the main duct, at the apex of the Small Papilla.

SPLEEN.

- 92 **Shape.** The Spleen is oblong and flattened. The **External Surface** is convex;—it is in relation with the diaphragm and ribs.

The **Internal Surface** presents in the middle a ridge with orifices for the blood vessels and called the *hilum*;—the surface in front is in relation with the stomach;—the surface behind is in relation with the tail of the pancreas and the left supra-renal capsule.

The **Anterior and Posterior Borders** are convex and sometimes notched.

The **Upper Extremity** is thick;—it gives attachment to the spleno-phrenic omentum, or “suspensory ligament;”—it is in relation with the diaphragm.

The **Lower Extremity** is pointed;—it gives attachment to the spleno-colic omentum;—it is in relation with the angle of the colon.

- 93 **Structure.** 1st, The spleen has an *External* or *Peritoneal* endothelial coat,—and a thick *Fibro-muscular coat* reflected at the hilum into the organ and forming sheaths for the vessels;—2d, The *Proper Tissue* of the spleen is composed of alveoles containing the splenic pulp composed of splenic corpuscles, lymphoid cells, pigment granules, red blood corpuscles (normal and distorted), cells containing blood corpuscles entire or in fragments, and cells containing pigment;—3d, The *Arterial Capillaries* open into the alveoles as in the erectile tissues and as the lymphatic capillaries do in the lymphatic glands;—4th, The *Venous Capillaries* originate by dilated orifices on the inner walls of the alveoles;—the splenic vein is one of the large formative veins of the portal system.

94 Peculiarities of the Liver.

It is the heaviest organ in the body.

It is the largest solid organ of the body.

Its color is peculiar brown (like the kidneys).

It occupies three regions, the right hypochondrium, the epigastrium and the left hypochondrium.

Its shape is peculiar and unique, resembles the half of an ovoid.

The Upper Border: Is adherent to the aponeurotic diaphragm.— It presents the notch for the Inferior Cava Vein.— It presents the Large Hepatic Veins opening into this Cava.

The Lower Border: Presents a notch for the peculiar Gall bladder.— Also for the peculiar Round Ligament.— It does not descend below the chondral border.

The Under Surface: Is peculiar in presenting five grooves or fissures in which are centered about all the important features of the organ.— Also by presenting three separate lobes, the Spigelian, the Square, the Caudate.

The Relations: Are remarkable and important: diaphragm and pleura, stomach, duodenum, small intestines, colons, supra-renal capsule, kidney, inferior cava.

It is a friable organ.

The Reflection of the Fibrous Coat into the interior of the organ (Capsule of Glisson) is nowhere so well marked.

The Radiated arrangement of the Hepatic Cells in the lobules is unique.

The Double Peri-lobular plexuses, *i. e.*, formed by the Portal Vein and the Hepatic Artery, is unique.

The origin of the Central Intra-lobular Hepatic Veins is unique.

The Exit of the Hepatic Veins at a point distant from the other vessels is most rare.

The adhesion of the walls of the hepatic veins to the hepatic tissue is unique.

The origin of the bile radicles by a dilatation surrounded by cells, if admitted, is unique.

The Excretory Apparatus is the most extensive and complicated.

The presence of a reservoir, the gall bladder, is rare (like the seminal vesicles and the bladder).

The Walls of the Gall Bladder possess a distinct muscular coat.— Its mucous membrane is reticulated, like the urinary bladder.

The Cystic Duct is twisted, like Wharton's Duct and sweat glands.

The course of the Common Bile Duct along with the Pancreatic Duct is unique.

The presence of the Large Papilla is rare (like the small pancreatic duct, Wharton's duct).

The Walls of the ducts have a distinct muscular coat (unique).

The walls also have microscopical racemose glands (a unique case).

The Hepatic Artery is remarkably small for the organ.

The Portal Vein System is unique in size; (the other instance is in the glomerule of the kidney).—Here is the only instance where a vein penetrates into an organ like an artery, and is distributed through the organ after the fashion of an artery.

It has no valves.

The Hepatic Veins do not follow the arteries, a unique case (except the veins of the brain).

They have no valves.

The nerves come direct from the left pneumo-gastric indirectly from the solar plexus; there they take support on the hepatic artery.

95 **Peculiarities of the Pancreas.**

It is the largest racemose gland.

Its situation remarkable; it is deeply seated, across the vertebral column.

Its shape is peculiar; a dog's tongue, a hammer.—The presence of a head, neck and tail is peculiar.

The Surfaces are more distinctly grooved and lobulated than any other gland.—The Upper Border presents a groove for the splenic vein, a unique case.—The artery is on top of the vein.

Its Relations are numerous and important: duodenum, spleen, supra-renal capsule, aorta, inferior cava, portal vein, thoracic duct.

It presents two distinct large visible ducts, a unique instance.—The openings of the ducts present prominent papillæ (like the duct of Wharton).

It possesses one single large artery,—which is on top of the vein.

The veins form the portal system.

96 **Peculiarities of the Spleen.**

Its color is peculiar: a slate color.

Its size varies more than that of any other organ.

It is deeply seated in the left hypochondrium.

Its shape is peculiar; prismatic.

The Inner Surface presents a ridge upon which is located the hilum.—Everywhere else the hilum is in a depression. (transverse fissure of liver, kidneys, lungs, ovaries, lymphatic glands).

The Borders are sometimes notched.

The Larger Extremity is turned upward (like the kidney).

It is very friable (like liver, kidney, brain).

The Subperitoneal Coat contains muscular fibres in abundance, a unique case.

The Walls of the Microscopic Alveoles are formed of the peculiar adenoid tissue.

The contents of the microscopic alveoles are peculiar in number: cells containing blood corpuscles, entire or in fragments; cells containing pigment, red blood corpuscles normal and distorted, the pigment granules, the corpuscles (which are very different from those of the kidneys)—Also lymphoid cells; but these are found in all the other lymphoid organs (tonsils, isolated follicles, Peyer's Patches, supra-renal capsules, thyroid body, thymus, pituitary body).

The Artery is remarkable for its size compared to the organ.—It terminates into the microscopic alveoles by free extremities.

The Intermediate Capillaries or Capillaries Proper are replaced by the microscopic alveoles.

The Venous Capillaries originate by dilated free extremities.

The Splenic Vein is unusually large.—It forms the Portal Vein.—It has no valves.

The Lymphatics originate from the peculiar lymph spaces in the adenoid tissue.

The Nerves take support on the artery as in almost all the viscera.

URINARY ORGANS.

- 97 **Enumeration.** The urinary organs comprise the supra-renal capsules, the kidneys, calices, pelvis, ureters, bladder, prostate and urethra.

SUPRA-RENAL CAPSULES.

- 98 **Shape.** The supra-renal capsules are flattened and triangular, and resemble a liberty cap.
 The **Anterior Surface** is in relation with the liver on the right and the spleen on the left side.
 The **Outer Border** is convex.
 The **Lower Border** or base caps the kidney.
 The **Inner Border** receives the vessels.
 The **Apex** presents nothing special.
 The **Posterior Surface** is in relation with the diaphragm.
Structure. The supra-renal capsules are composed:—1st, of an *External* or *Fibrous* coat;—2d, of the *Proper Tissue*, which is composed of a cortical or yellow portion and of a medullary or gray portion.—Both substances are composed of alveoles containing lymphoid cells.

KIDNEYS.

- 99 **Shape.** The kidneys are flattened, oval bodies; they resemble a bean.
 The **Anterior Surface** is convex; it is in relation with the

ascending colon and liver on the right and the descending colon and spleen on the left side.

The **Internal Border** presents a notch called the *hilum*, where the renal artery and the nervous filaments penetrate the organ and where the veins, lymphatic vessels and the pelvis come out of it.

The **External Border** is convex;—it rests on the square lumbar muscle.

The **Upper Extremity** is thick;—it is in relation with the supra-renal capsule.

The **Lower Extremity** is thin and is about two inches from the crest of the ileum.

The **Posterior Surface** is almost flat;—it is in relation with the pillars of the diaphragm, the psoas muscle, the square lumbar muscle and the vertebral column.

- 100 **Structure.** The kidneys are composed:—1st, of a *Cellulo-adipose* capsule;—2d, of a *Fibrous Coat* reflected at the hilum into the organ;—3d, its *Proper Tissue* is composed of an *external cortical* or granular substance and of an *internal or medullary* or pyramidal substance.—Both substances are composed of the *Uriniferous Canalicules*, which are straight in the medullary substance, but very much convoluted in the *cortical* portion,—where they terminate by a dilatation called the *Capsule* of Malpighi, containing a tuft of convoluted capillaries called the *Glomerule*,—the whole forms the *Corpuscle of Malpighi*.

CALICES.

- 101 **Shape.** The calices are cylindrical and funnel-shaped.
The **Anterior Surface** is in relation with the renal artery and vein.
The **Outer Extremity** is attached around the apex of the corresponding pyramid of Malpighi.
The **Inner Extremity** is attached to the pelvis.
The **Posterior Surface** is in relation with the adipose capsule.
Structure. They are composed:—1st, of an *External or Fibrous Coat*, and—2d, of an *Internal or Mucous Coat*.

PELVIS.

- 102 **Shape.** The pelvis is a funnel-like pouch.
The **Anterior Surface** is in relation with the renal artery and vein.
The **Upper Border** is convex.
The **Lower Border** is concave.
The **Base** receives the calices.
The **Apex** is continuous with the ureter.
The **Posterior Surface** is in relation with the cellulo-adipose capsule and the psoas muscle.
Structure. The Pelvis is composed:—1st, of a *Fibrous Coat*, slightly elastic and muscular;—2d, of a *Mucous Coat*.

URETER.

- 103 **Direction and Course.** The ureter descends obliquely inwards along the psoas muscle,—enters the pelvic cavity,—crossing the angle of bifurcation of the iliac vessels—and, curving forwards and inwards in the vesical fold of the peritoneum,—reaches the fundus of the bladder.

Shape. The ureter has the shape of a long, narrow and thin tube.

The **Anterior Surface** is in relation with the peritoneum and base of bladder.

The **Upper Extremity** is continuous with the pelvis.

The **Lower Extremity** opens into the bladder—in a valve-like manner.

The **Posterior Surface** is in relation with the psoas,—then the angle of bifurcation of the iliac vessels,—then the pelvic areolar tissue, the rectum, the spermatic duct and the seminal vesicles.

Structure. The ureter is composed:—1st, of an *External Fibrous* and slightly elastic and muscular layer;—2d, of a thin *Mucous Coat*.

BLADDER.

- 104 **Shape.** The bladder when distended is ovoidal.

The **Anterior Surface** is deprived of peritoneum except sometimes near the apex;—it is in relation with the pubis.

The **Posterior Surface** is covered by peritoneum;—it is in relation with the upper part of the rectum.

The **Lateral Surfaces** are covered by peritoneum only in their upper and back part.

The **Apex** gives attachment to the urachus.

The **Base of Fundus** is in relation with the prostate in front and the rectum behind;—on the sides it is in relation with the seminal vesicles, the spermatic ducts and ureters.

The **Neck of the Bladder** is situated in advance of the fundus,—is funnel-like,—is in relation with the anterior and lateral ligaments of the bladder.

- 105 **Structure.** The bladder is composed:—1st, of a *Peritoneal Coat* which covers only its posterior surface and the upper back part of the lateral surfaces;—2d, of a layer of *Longitudinal Muscular Fibres* originating from the pubis and prostate below and above from the urachus;—3d, of a *Layer of Circular Fibres* which thicken and form the *Sphincter*;—4th, of a *Layer of Plexiform Fibres*;—5th, of a *Mucous Coat* which presents at the back a depressed portion called the *Bas-fond*, and in front a triangular space called the *Trigone*, the angles of which are formed by the urethra and the two ureters.

PROSTATE.

106 **Shape.** The prostate is triangular.

The **Lateral Surfaces** are in relation with the pelvic areolar tissue.

The **Under Surface** presents sometimes a middle lobe and two lateral lobes:— it is in relation with the rectum.

The **Base** is directed backwards—it is in relation with the apices of the seminal vesicles and the ejaculatory ducts.

The **Apex** is directed forwards—it is in contact with the membranous portion of the urethra.

The **Upper Surface** forms the floor of the prostatic portion of the urethra—it presents the urethral crest, the utricle, the openings of the ejaculatory ducts and of the ducts of the prostate itself.

Structure. The prostate is composed,— 1st, of an *External* or *Fibrous Coat*;— 2d, of a *Proper Substance* composed of smooth muscular fibres and of simple racemose glands, which open into the prostatic urethra.

107 **Peculiarities of the Supra-Renal Capsules.**

Their size is remarkable; the older the subject the smaller they are.

Their color is peculiar, yellow brown.

Also their shape: a liberty cap.

Also their situation: over the kidney, with which they have no connection, neither anatomical nor physiological.

Their structure is peculiar in containing some special stellate bodies.

It has a cavity in its centre; the only lymphoid gland having it, except the pituitary body.

The arteries are numerous, specially compared with the size of the organ.

Peculiarities of the Kidneys.

Their color is peculiar (like the liver).

They are situated at the deepest part of the abdominal cavity.

The right is lower than the left.

Their shape is unique: that of a bean.

The hilum is one of the most distinct (like the liver).

The upper extremity is the largest (like the spleen).

The posterior surface is free from peritoneum and can be entered from behind without injuring the peritoneum.

It possesses a cellulo-adipose capsule (a unique instance).

Its proper tissue is characteristic.

The cortical is unique.

The pyramids are unique.

The harder of the two substances is in the centre.

The dichotomous division of the canalicules is unique.

It is the only tubular gland that is lobulated (pyramids of Ferrein) with the testicles.

The Malpighian Corpuscle is unique (it is very different from the splenic corpuscle).

The Glomerule is unique.

The Capillary Arterial Portal System is unique.

The Arteries are very large in proportion to the organ.

The smaller branches run between the pyramids of Ferrein in a peculiar way.

The Veins are peculiarly larger than the arteries; they carry red blood.

They originate not from the glomerule, but from the capillary plexus, etc.

The superficial Venous Capillaries originate on the surface of the kidney in a star-like arrangement called the Stars of Verheyen.

The left is lower than the right.

They carry purer blood than the arteries.

The vessels are in front of the pelvis and are away from the knife in operations on the kidney and pelvis.

108 Peculiarities of the Excretory Apparatus of the Kidneys.

Is very peculiar.

The real beginning of the apparatus is the canicules from the corpuscles to the calices.

The balance is represented by the calices, the pelvis, the ureter, the bladder, the urethra.

Peculiarities of the Calices.

Are unique: no similar arrangement exists anywhere else.

Peculiarities of the Pelvis.

Is also unique: nothing similar is found anywhere else.

109 Peculiarities of the Ureters.

Are peculiar on account of their length and size.

Also on account of their mode of termination into the bladder.

Peculiarities of the Bladder.

Is the largest receptacle found on the course of any excretory apparatus.

Its shape is unique, having two apices, the neck and the urachus.

The anterior surface is deprived of peritoneum.

The urachus is unique.

The Base is also deprived of peritoneum.

The Neck with a sphincter is unique, in an excretory apparatus.

It has three sets of fibres (like the stomach).

The Mucous Coat is reticulated (like the gall bladder).

Its bas-fond is unique.

The trigone is unique.

The Arteries are numerous, three on each side.

The Veins form a plexus around the neck.

The nerves of the neck come from the hypogastric plexus.—The nerves of the base come from the sacral plexus.

Peculiarities of the Prostate.

- Is unique.
- Its size increasing with age is unique.
- Its color is fleshy (like the thyroid body and thymus).
- Its shape is unique.
- Its urethral crest and utricle are unique.
- Its being traversed by the urethra and ejaculatory ducts is unique.
- Its stroma of smooth muscular fibres is unique.
- Its excretory ducts are numerous (like the sublingual).
- It is the analogue of the female uterus, but the uterine glands are tubular.
- The Veins surrounding it are numerous.

MALE ORGANS OF GENERATION.

- 110 **Enumeration.** The male organs of generation consist of the Scrotum, the Testicle, the Epididymis, the Spermatic Duct, the Seminal Vesicles, the Ejaculatory Ducts, the Penis and the Urethra.

SCROTUM.

- 111 **Structure.** The scrotum is composed :
- 1st, of the *Skin* or *Scrotum Proper*.
 - 2d, of the *Dartos* and *Dartoid Tunic*, composed of elastic and smooth muscular fibres.
 - 3d, of the *Erythroid Tunic*, formed by the Cremaster muscle.
 - 4th, of the *Fibrous Tunic*, corresponding to the Fascia Transversalis.
 - 5th, of the *Vaginal Tunic*, which is a serous membrane lining the inner surface of the fibrous tunic and the outer surface of the testicle and epididymis.

TESTICLE.

- 112 **Shape.** The testicle resembles a pigeon's egg, slightly flattened transversely.
- The **External Surface**, the **Internal Surface** and the **Anterior Border** are convex and smooth.
- The **Posterior or Upper Border** adheres to the epididymis except in the middle.
- The **Anterior or Upper Extremity** and the **Posterior or Lower Extremity** are convex and smooth.
- Structure.** The testicle is composed:—1st, of a *Serous Layer* formed by the vaginal tunic;—2d, of the *Albugineous* or *Fibrous Coat*, very strong and unyielding—thickened at the back part of the testicle to form the *mediastinum*;—it contains the longitudinal *mediastinal ducts* which open into

the vascular cones of the epididymis;—3d, of *Alveoles* containing the *Seminiferous Canalicules* which open into the mediastinal ducts and which are lined by the special *Sperm Cells*.

EPIDIDYMIS.

- 113 **Shape.** The Epididymis is elongated and narrow, and resembles a leech.

The **Upper Surface** is partly free and partly adherent to the fibrous portion of the vaginal tunic.

The **Under Surface** is adherent to the testicle in front and behind,—but is free in the middle.

The **Anterior Extremity or Head** is firmly attached to the testicle.

The **Posterior Extremity or Tail** is also adherent to the testicle.

Structure. The epididymis is composed:—1st, of a *Serous Coat* from the vaginal tunic;—2d, of a *Fibrous* or *Albugineous Coat* similar to that of the testicle;—3d, the *Head* is composed of a dozen convoluted tubes called the *Spermatic Cones* which originate from the mediastinal ducts and terminate in a single coarse convoluted tube,—the *Canal of the Epididymis* forming the body and tail of the organ; it is continuous with the spermatic duct.

SPERMATIC DUCT (VAS DEFERENS).

- 114 **Direction and Course.** The spermatic duct ascends with the spermatic vessels in the scrotum;—it traverses the inguinal canal,—then curves into the pelvic cavity to reach the side of the bladder and the fundus, where it joins the excretory duct of the seminal vesicle.

Shape. It is a long, small, hard duct.

The **Surfaces** are in relation:—*In the Scrotum*, with the vessels behind which it is situated;—*in the Inguinal canal* the duct rests on the floor:—at the *Internal Inguinal Orifice* it becomes separated from the vessels;—*in the Pelvis* it rests on the sides of the bladder, crossing the ureter;—*beneath the fundus* it lies to the inner side of the seminal vesicles.

The **Outer Extremity** is continuous with the canal of the epididymis.

The **Inner Extremity** is continuous with the duct of the seminal vesicle—and forms with it the ejaculatory duct.

Structure. The spermatic duct is very thick, with a small capillary channel. It is composed:—1st, of a *Fibrous Coat* and—2d, of a *Mucous Coat* lined by a stratified columnar epithelium.

SPERMATIC CORD.

- 115 **Structure.** The spermatic cord is composed of the *spermatic duct*, the *spermatic artery*, the *spermatic veins*, *lymphatic vessels*, *sympathetic nervous filaments*; of *areolar tissue* and of a portion of the *fibrous layer* of the scrotum and *cremaster muscle*.

SEMINAL VESICLES.

- 116 **Shape.** The seminal vesicles are flattened oval bodies.
 The **Under Surface** is convoluted—it is in relation with the rectum.
 The **External Border** is convex and sacculated.
 The **Internal Border** is in relation with the spermatic duct.
 The **Posterior Extremity** is rounded and free.
 The **Anterior Extremity** gives rise to the ejaculatory duct;—it is in relation with the base of the prostate.
 The **Upper Surface** is in relation with the base of the bladder.
Structure. The seminal vesicles are composed:—1st, of an *External Fibrous Coat*;—2d, of a *Coarse Tube* closed at its posterior extremity, convoluted into a mass presenting diverticles;—the walls of this tube are formed of a fibro-muscular coat lined by a reticulated *mucous layer* with cylindrical epithelium.

EJACULATORY DUCTS.

- 117 **Shape.** The ejaculatory ducts are conical tubes.
 The **Surfaces and Borders** are intimately adherent to the prostatic tissue.
 The **Posterior Extremity** communicates with the seminal vesicle and ejaculatory duct.
 The **Anterior Extremity** opens into the urethra by a slit-like orifice on the side of the utricle.
Structure. The Ejaculatory ducts are composed of a *Fibro-Muscular* layer lined by *Mucous Membrane*.

PENIS.

- 118 **Structure.** The penis is composed, from the surface to the deep parts:—1st, of the *Skin*;—2d, of a *Dartoic Layer*;—3d, of a *Fibro-elastic Sheath* binding together the three bodies forming the bulk of the penis;—4th, of the *Two Cavernous Bodies* composed of an *external albugineous* fibrous layer and of *alveoles* into which the capillary arteries open by a free extremity and from which the venous radicles origi-

nate by a dilated extremity;—5th, of the *Spongy Body*, which is traversed by the urethra;—it presents in front an expansion called the *Glans Penis* and one behind called the *Bulb* of the urethra;—it has the same structure as the cavernous bodies, only the fibrous layer is thinner and the alveoles smaller.

MALE URETHRA.

- 119 **Dimensions.** The male urethra measures from eight to ten inches;—the *prostatic* measures one inch and a quarter,—the *membranous* three-quarters of an inch—and the *spongy* about six inches.

Diameters. The meatus is the narrowest part;—then it expands to form the Navicular Fossa—and contracts again along the spongy body;—the membranous portion is narrower than the spongy but is dilatable;—the prostatic portion is the widest and is the most dilatable.

Direction. In the *flaccid state* it presents *two curves* and resembles an italic *S*;—in the straightened or *erect state* there is but *one curve*, the permanent curve, with the concavity directed upwards;—it extends from the bulb to the bladder, passing through the middle perineal fascia;—it has its centre a little behind the pubis.

Shape. The urethra is cylindrical, in a general way.

The **External Surface** adheres closely to the structures which it traverses.

The **Internal Surface** presents in the spongy portion and on the upper wall principally *blind pouches*.—In the bulbous portion, on the floor, it presents the *orifices of Cowper's glands*.—In the prostatic portion it presents on the floor also the *urethral crest*, the *utricle*, the *opening of the ejaculatory ducts* and of the *prostatic ducts*.

Structure. The urethra is composed:—1st, Of a *Mucous Membrane* with a columnar epithelium and simple racemose glands;—2d, Of a *Fibro-elastic and Muscular Submucous Layer*;—3d, In its course from the bladder to the meatus, the canal thus constituted is *reinforced* by the organs which it traverses; *i. e.*, the prostate, membranous urethra and spongy body, which form additional coverings or walls.

COWPER'S GLANDS.

- 120 **Dimensions.** Cowper's glands are about the size of a cow-pea.

Situation. They are situated in the folds of the middle perineal fascia.

Structure. They are racemose glands;—the ducts open on the floor of the bulbous urethra.

PECULIARITIES OF THE MALE ORGANS OF GENERATION.

121 Peculiarities of the Scrotum.

The thinness of the *Skin* is noticeable when not corrugated (like the penis and lids).

The Hair follicles are particularly large.

The *Dartoic Tunic* corresponds to the subcutaneous areolar tissue in other situations.

It is very abundant.

It is mixed with smooth muscular fibres.

Fat never accumulates in it (like the lids and penis).

The *Erythroid Tunic* and *Cremaster Muscle* are unique.

The *Fibrous Tunic* corresponds to the pericardium and to the dura mater.

The *Vaginal Tunic* is peculiar in having been formed by the peritoneum.

122 Peculiarities of the Testicles.

Are unique.

That one is larger and hangs lower than the other is peculiar.

Their shape is unique.

The thickness of the fibrous coat is peculiar.

The presence of the Mediastinum is peculiar.

The Mediastinal Ducts are unique.

The division of the interior into alveoles is more marked here than anywhere else.

The lobulated condition is shared by the kidneys.

The diverticles on the seminiferous canalicules are unique.

The sperm cells lining the canalicules are unique (the peptic glands recall this, *i. e.*, the presence of peculiar cells lining some tubular glands).

The Artery is peculiar for its origin so far away from the organ.—Also for its slender size.—Also for its close attachment to the spermatic duct.

The Capillaries form a peculiar layer on the walls of the alveoles.

The Lymphatics discharge in the pelvis glands.

The Nerves are peculiar, and pressure on the organs produces a characteristic sickening feeling.

Peculiarities of the Epididymis.

It is unique.

It is the beginning of the excretory apparatus of the testicle, which comprises the mediastinal duct, the cones and canal of the epididymis.—the spermatic duct, the seminal vesicles, the urethra.

Its shape is unique.

Its fibrous coat is thick and unyielding (like the testicle and the sclerotic).

The spermatic cones are unique.

The Canal of the Epididymis is unique.

123 Peculiarities of the Spermatic Duct.

It is remarkable for its length; it is the longest of all excretory ducts.

Its independence from the veins and other parts of the spermatic cord is peculiar.

It joins another duct (like the common bile duct).

Its small size is peculiar.

Also the thickness of its walls and its small calibre (like the parotid).

The Spermatic Artery is closely attached to it.

Its veins are loose and away from it.

Peculiarities of the Spermatic Cord.

It recalls the umbilical cord.

Only, it has but one artery and several veins, whereas the umbilical cord has one single vein and several, *i. e.*, two arteries.

The Veins are loose and away from the spermatic duct.—They terminate on the right in the Inferior Cava and on the left into the Renal Vein.

Peculiarities of the Seminal Vesicles.

Are the analogues of the gall bladder and the urinary bladder.

Their shape is peculiar.

The sacculated or grooved appearance of their surface is peculiar.

The partitioned appearance of the interior is unique.

They possess smooth muscular fibres in their walls (like the gall bladder).

Peculiarities of the Ejaculatory Ducts.

They resemble the Common Bile Duct.

They are peculiar in traversing the prostate gland itself.

124 Peculiarities of the Penis.

It is unique in all respects.

It corresponds to the female clitoris.

The skin is thin (like the lids and scrotum).

The Dartoic layer has not so many muscular fibres as the scrotum.

The Two Cavernous Bodies are unique.—The Two Roots are peculiar.—Their Anterior Blunt Extremity is peculiar.—The absence of communication with the spongy body is peculiar.—Their Fibrous Coat is peculiarly thick and unyielding (like testicle, epididymis, sclerotic).

The Spongy Body is peculiar.—Its expansion anteriorly to form the glans and posteriorly to form the bulb is peculiar.

The Structure of these three bodies is peculiar; that of all erectile tissue (like the spleen).

The Penis has two arteries to one vein.

The Capillaries have a corkscrew course and terminate by opened extremities.

The Capillaries Proper are replaced by the cavities of the erectile tissue.

The Venous Capillaries begin by an open dilated extremity.

The Vein is unique.—It has no valves.

The Lymphatics from the skin empty into the inguinal glands, while those of the deeper structures empty in the pelvic gland.

The Nerves terminate in the glans in peculiar corpuscles.
Peculiarities of the Male Urethra.

It is peculiar in its length.

In its varying diameters (like the œsophagus).

In its direction, presenting a changeable and a permanent curve.

It is remarkable because it traverses three different structures or regions.

Its internal surface presents the blind pouches, also the urethral crest, the utricle, the slit-like openings of the ejaculatory ducts, the many openings of the prostate glands and openings of Cowper's glands.

Peculiarities of Cowper's Glands.

Are peculiar in their situation.

Also because they correspond to the glands of Bartholin in the female.

PERICARDIUM.

125 1st, The Fibrous Pericardium.

Shape. The fibrous pericardium is conical.

The **Anterior Surface** is in relation with the sternum.

The **Lateral Surfaces** are in relation with the phrenic nerves, the pleura and lungs.

The **Base** is closely attached to the aponeurotic diaphragm.

The **Apex** surrounds the large vessels at the base of the heart.

The **Posterior Surface** is in relation with the trachea, bronchi, œsophagus, aorta.

126 2d, The Serous Pericardium.

Course. The serous pericardium invests the interior of the fibrous pericardium—it is then reflected upon the surface of the heart.

HEART.

127 **Shape.** The heart is conical, a little flattened from before backwards.

The **Anterior Surface** presents the anterior interventricular and auriculo-ventricular grooves—the initial portions of the aorta and pulmonary artery,—the left and right auricular appendages.

The **Upper or Left Border** is the sharpest.

The **Lower or Right Border** is the broadest and is almost straight;—it rests upon the aponeurotic diaphragm.

The **Base** is turned upwards and to the right; it presents the pulmonary artery, the aorta, the descending cava, the upper or left pulmonary veins.

The **Apex or Point** corresponds to the fifth intercostal space, a little below and to the right of the left nipple.

The **Posterior Surface** presents the posterior interventricular and auriculo-ventricular grooves, the ascending cava, the great coronary vein and the two lower or right pulmonary veins.

STRUCTURE OF THE HEART.

128 The heart is composed :

1st, of the **Visceral Layer** of the serous pericardium.

2d, of a **Muscular Layer**.—*In the Auricles* there is a superficial common circular layer and a separate loop-like set of fibres for each auricle, attached to the fibrous rings of the orifices;—there is a set of circular fibres around the orifices of the large veins. *In the Ventricles* there is the same arrangement, but at the apex the fibres penetrate into the ventricles and form the *Fleshy Columns or Muscles*.—The fibres are *striated*, are narrow and *anastomose*.

3d, of an **Internal Serous Layer** called the *Endocardium*, lining the interior of the cavities of the heart.

In the Auricles, the *Inner Wall* presents the inter-auricular septum or oval fossa;—the *Outer Wall* presents the orifice of the auricular appendage;—the *Anterior Wall* presents nothing special;—the *Posterior Wall* presents on the right side the orifice of the ascending and descending cava and on the left side the orifices of the pulmonary veins;—the *Lower Wall* presents the auriculo-ventricular orifice and valve.

In the Ventricles we find the *Fleshy Columns or Muscles* and *Tendinous Cords*;—the *Inner Wall* forms the interventricular septum,—the *Anterior and Posterior Walls* and the *Apex* are covered with fleshy columns;—the *Base* presents the auriculo-ventricular orifices and valves, the tricuspid on the right and the mitral on the left;—it presents also the Pulmonary and Aortic Orifices guarded each by a set of semi-lunar valves.

PECULIARITIES OF THE CENTRAL ORGANS OF CIRCULATION.

129 **Peculiarities of the Fibrous Pericardium.**

It is most peculiar and almost unique.

Its walls resemble the fibrous tunic of the scrotum.

It was rendered necessary here from the lack of any other support for the serous pericardium.

Its base corresponds to the point of the heart.

This base is attached to the aponeurotic diaphragm.

The lateral surfaces are lined by a serous membrane, the pleura; it is therefore placed between two serous membranes.

The phrenic nerves take support on the lateral surfaces.

Peculiarities of the Heart.

Is a unique organ in the body.

The whole of it is peculiar and must be studied as such.

A most peculiar feature is that although it is an organ which is not under the influence of our will, yet its fibres are striped fibres.

Besides, those fibres are narrower than anywhere else.

Also they anastomose, which is a unique instance.

The arteries are numerous.

They originate below the edge of the semilunar valves.

They fill during ventricular diastole and by arterial systole.

They form two circles, one in the interventricular groove and the other around the base in the auriculo-ventricular groove.

The veins form two groups.

Those of the left heart centre into the Great Cardiac Vein, which presents an effective valve.

It is the only vein of the heart having an effective valve.

The right heart is drained by the peculiar veins of Thebesius.

The Nerves come from the peculiar cardiac plexus.

Three from the sympathetic and three from the cervical plexus.

They present the Ganglion of Remak at the base of the heart.

The inhibitory or moderating nerve is the sympathetic.

RESPIRATORY ORGANS.

- 130 **Enumeration.** The organs of respiration are: the Larynx, Trachea, Bronchi, Lungs, Pleura, Thyroid Body and Thy-mus Gland.

LARYNX.

- 131 **Shape.** The larynx is triangular and prismatic.
The **Base** is turned upwards and corresponds to the hyoid bone.
The **Apex** is turned downwards and is continuous with the trachea.
The **Anterior Border** presents a projection called *Adam's Apple*; it is subcutaneous.

The **Lateral Surfaces** are in relation with the sterno-hyoid, omo-hyoid, thyro-hyoid and sterno-thyroid and the skin.

The **Lateral Borders** give attachment to the pharynx.

The **Posterior Surface** is situated in the lower portion of the pharynx.—It presents from above downward the *Epi-glottis and its Folds* (the middle and lateral glosso-epiglottic and the aryteno-epiglottic)—the *orifice of the larynx*,—a *square surface*, corresponding to the cricoid cartilage.

The **Interior of the Larynx** presents the *upper glottic space*; — the upper or *false vocal cords*,—the *ventricle*,—the lower or *true vocal cords* limiting the *glottis* or *rima*,—the *inter-arytenoid space*,—the inferior or *lower glottic space*.

STRUCTURE OF THE LARYNX.

- 132 The larynx is composed: of bone, cartilages, fibro-cartilage, articulations, muscles, mucous membrane, vessels and nerves.

1st. The **Bone** is the hyoid.

2d. The **Cartilages** are the thyroid, cricoid, arytenoid, cuneiform and corniculate.

3d. The **Fibro-Cartilage** is the epiglottis.

4th. The **Articulations** of the larynx are the crico-thyroid (median or anterior and lateral or posterior);—the crico-arytenoid,—the aryteno-thyroid (or ligaments of the true and the false vocal cords);—the ligaments of the epiglottis, which are the hyo-epiglottic, the thyro-epiglottic, the aryteno-epiglottic, and the glosso-epiglottic.

5th. The **Muscles** are the crico-thyroid,—the thyro-epiglottic,—the aryteno-epiglottic superior,—the aryteno-epiglottic inferior,—the crico-arytenoid lateral,—the crico-arytenoid posterior,—the arytenoid.

The muscle which *opens the glottis* is the crico-arytenoid posterior.

The muscles which *close the glottis* are the arytenoid and the crico-arytenoid lateral.

The muscle which *tenses and elongates the vocal cords* is the crico-thyroid.

The muscle which *relaxes and shortens the vocal cords* is the thyro-arytenoid.

6th. The **Mucous Membrane** is lined by a ciliated epithelium—it has numerous simple racemose glands.

7. The **Nerves of the Larynx** are: 1st, the *Superior Laryngeal*, distributed to the crico-thyroid and to the mucous membrane;—2d, the *Inferior or Recurrent Laryngeal*, distributed to all the other muscles and also to the mucous membrane.

VERBIL MAN

TRACHEA.

133 **Shape.** The trachea is cylindrical, but flattened behind. The **Anterior Surface** presents ridges and grooves corresponding to the cartilages and their spaces.—It is *in relation in the neck* with the isthmus of the thyroid body, the middle thyroid artery and vein, the fascia and skin;—*in the chest*, with the left innominate vein, the arch of the aorta and the pericardium.

The **Lateral Surfaces** present also ridges and grooves. They are in relation—*in the neck* with the lobes of the thyroid body, the sterno-thyroid, the sterno-hyoid, the carotid and the recurrent laryngeal;—*in the chest* on the right with the innominate artery, the right carotid, and on the left with the left carotid and the arch.

The **Upper Extremity** is continuous with the trachea.

The **Lower Extremity** divides into the right and left bronchi.

The **Posterior Surface** is flattened;—it has no rings and is membranous.—It is in relation all along with the œsophagus and pneumo-gastric nerves.

134 **Structure.** The trachea is composed: 1st, of *Cartilaginous Segments* connected by *Fibrous Tissue*;—2d, the *Posterior Wall is altogether membranous*;—3d, of a layer of *Transverse, smooth muscular fibres*;—4th, of a layer of *Longitudinal elastic fibres*;—5th, of a *Mucous layer* with a ciliated epithelium—and provided with simple racemose glands.

BRONCHI.

135 **Shape.** The Bronchi are cylindrical, but flattened behind. The **Anterior Surface** presents cartilaginous ridges and fibrous interstices.—It is in relation with the pericardium, pulmonary artery and veins, and bronchial artery and veins;—the right is in relation with the descending cava.

The **Upper Surface** on the right is arched over by the great azygos vein,—and on the left by the arch of the aorta.

The **Under Surface** gives attachment to the ligament of the bronchi and to the broncho-phrenic ligament.

The **Posterior Surface** is flat and membranous.—It is in relation on the right with the azygos vein and on the left with the aorta.

The **Internal Extremity** is continuous with the trachea.

The **External Extremity** penetrates into the lung,—where it divides dichotomously, each division ending in a dilated extremity which forms the pulmonary lobule.

136 **Structure.** The *Large or Extra-Pulmonary Bronchi* have the same structure as the trachea.—The *Medium-sized Bronchi* have also the same structure, but the cartilage segments form complete rings.—In the *Smaller Bronchi* the cartilages

gradually disappear.—In the *Terminal and Capillary Bronchi*, there exists only a fibro-elastic layer with circular smooth fibres and a lining mucous membrane.

LUNGS.

137 **Shape.** The lungs are conical.

The **External Surface** is convex;—it presents the interlobar fissures dividing the right lung into three lobes and the left into two lobes.

The **Internal Surface** is concave;—it presents near the middle a deep groove, the *hilum* through which the bronchi, the veins and the pulmonary artery, the bronchial artery and the nerves penetrate into the lung and the corresponding veins and the lymphatics come out;—all those elements are surrounded by the pleura and form the root or pedicle of the lung.

The *surface behind the hilum* corresponds to the posterior mediastinum.

The *surface in front* corresponds to the pericardium and heart.

The *surface above* to the superior mediastinum.

The **Anterior Border** is thin and rests on the pericardium.

The **Base or Under Surface** corresponds to the diaphragm.

The **Apex** extends above the level of the first rib into the supra-clavicular region,—where it is in relation with the large vessels and nerves of that region.

The **Posterior Border** is thick—it lies on the side of the vertebral column.

138 **Structure.** The lungs are composed:—1st, of a *Serous or Pleural Coat*;—2d, of a *Fibro-elastic Coat* situated underneath it;—3d, the *Proper Tissue* is composed of alveoles called *lobules*, which may be considered as the dilated termination of the capillary bronchi;—the interior of the lobules present innumerable small depressions or pouches, which are the *air vesicles*.—The walls of the lobules and air vesicles are formed of delicate connective and elastic tissue;—they are lined by delicate epithelial plates;—4th, the *Arteries* are the pulmonary and the bronchial or nutrient;—5th, the *Veins* are the bronchial and the pulmonary.

PLEURA.

139 **Shape.** The pleura has the shape of a conical bag.

The **External Surface** lines the walls of the chest and is reflected on the lungs.

The **Internal Surface** is reflected upon itself.

PECULIARITIES OF THE ORGANS OF RESPIRATION.

140 Peculiarities of the Larynx.

It is a unique organ in the body.

The whole of it is peculiar and must be studied as such.

The True Vocal Cords are its most peculiar points.

The Ventricle of the larynx is also remarkable.

The Connective Tissue of the epiglottic fibres must be noticed.

The Arytenoid Cartilages are the centre or pivot of the whole larynx, because the vocal cords are attached to them behind, and because of this, almost all the important muscles of the larynx are attached to them.

The Cricoid is the first ring of the trachea.

The Nerves are peculiar.—The Inferior Recurrent Laryngeal nerve specially by its origin, its course, its termination.

141 Peculiarities of the Trachea.

Is a unique organ.

Its elasticity is remarkable.

The flat part of its posterior surface is remarkable.

The presence of the inferior recurrent laryngeal nerve in the groove is noticeable.

The alternating of incomplete cartilaginous rings and of fibrous rings is peculiar.

The presence of transverse muscular fibres posteriorly is noticeable.

Peculiarities of the Extra-Pulmonary Bronchi.

All the above remarks apply to them.

Besides, that the right bronchus is larger, more horizontal than the left, is remarkable.

Peculiarities of the Medium Intra-Pulmonary Bronchi.

Are peculiar because their cartilaginous rings encircle the whole diameter of the tube, but this cartilage is broken up into several segments.

Peculiarities of the Smaller Intra-Pulmonary Bronchi.

The cartilages disappear gradually.

Peculiarities of the Terminal or Capillary Bronchi.

They possess smooth muscular fibres.

They terminate by a dilatation which forms the pulmonary lobules.

Peculiarities of the Lungs.

Their shape is peculiar (like the supra-renal capsules).

Also their difference in size.

Their divisions in lobes is peculiar.

The uneven number of the lobes is peculiar.

The hilum is one of the best marked.

The large blood vessels are all in front of the bronchi.

The Apex extending above the first rib into the supra-clavicular space is noticeable.

The structure is peculiar.

They may be considered as compound racemose glands, the air vesicles representing the acini.

The tissue forming them is noticeable; all fibrous and elastic.

The air vesicles are lined by the peculiar epithelial plates.

It has two separate peculiar Circulatory Currents, the Pulmonary and the Bronchial.

The size and course of the Pulmonary Artery is remarkable, its termination unique.

The presence of four Pulmonary Veins to one artery is unique;—the Veins carry red blood.

The capillaries form three plexuses around the lobules.

The Bronchial Arteries are remarkably small, because they are only the nutrient arteries and the lungs being very porous contain but little solids and these are formed of tissues requiring but very little nutrition.

They do not form a part of the lobular plexuses.

The Bronchial Veins open into the Azygos and into the Superior Intercostal.

The Lymphatics open into the bronchial glands at the bifurcation of the trachea.

142 Peculiarities of the Pleura.

Is the most extensive serous membrane next to the peritoneum.

The two pleuræ limit the four mediastina.

ISTHMUS OF THE THYROID BODY.

143 Shape. The Isthmus is quadrilateral.

The **Anterior Surface** is in relation with cervical fascia and skin.

The **Upper Border** gives rise to the *pyramidal process*, which ascends to the hyoid bone.

The **Lower Border** receives the middle thyroid artery when it exists.

The **Lateral Borders** are continuous with the lobes.

The **Posterior Surface** is firmly attached to the trachea.

LOBES OF THE THYROID BODY.

144 Shape. The lobes of the thyroid body are conical.

The **External Surface** is covered by the sterno-hyoid and omo-hyoid.

The **Outer Border** is in relation with the carotid, the jugular, the pneumo-gastric.

The **Inner Border** is attached below to the isthmus,—but above it is separated from its fellow by the trachea.

The **Apex** is turned upwards.

The **Base** is turned downwards and projects beyond the isthmus.

The **Internal Surface** is in relation with the trachea, the cricoid and thyroid cartilages and the recurrent laryngeal nerve.

- 145 **Structure.** The thyroid body is composed:—1st, of an *External or Fibrous Coat*;—2d, of a *Proper Tissue* composed of alveoles resembling closed spaces or *vesicles* lined by a single layer of cells and filled with a granular fluid.

THYMUS.

- 146 **Shape.** The thymus consists of a pair of unequal lateral lobes, sometimes connected by a short isthmus.

The **Anterior Surface** is in relation with the sternum.

The **Posterior Surface** is in relation with the aorta, the pulmonary artery, the pericardium, the left innominate vein and the trachea.

Structure. The thymus is composed:—1st, of an *External or Fibrous Coat*;—2d, of a *Proper Tissue* divided into *hollow lobules* attached to a *hollow stem*;—the walls of the lobules are formed of a *Cortical* and a *Medullary* portion.—Both portions are composed of *alveoles* containing *lymphoid cells* and peculiar concentric bodies.

- 147 **Peculiarities of the Thyroid Body.**

Its color is peculiar.

Its shape also: two lobes and an isthmus (like the thymus).

It presents the peculiar pyramidal process.

The adhesion of the isthmus to the trachea is peculiar.

Its structure is peculiar, as presenting closed vesicles lined by a single layer of cells and filled with a granular fluid.

It has five arteries of good size.

They strike the organ at the angles.

Peculiarities of the Thymus.

The older the subject the smaller the organ.

The situation is peculiar.

Its irregular shape is peculiar; sometimes it presents two lobes united by a sort of isthmus.

Its structure is unique: hollow lobules attached to a hollow stem.

However, the structure of the walls of the lobules is fundamentally the same as the other lymphoid organ (a cavity is found also in the supra-renal capsules; also in the pituitary body; vesicles are found in the thyroid body).

MEMBRANES OF THE BRAIN.

- 148 **Enumeration.** The Brain is surrounded by the Dura Mater, the Arachnoid, the Sub-arachnoid Space with the Cerebro-spinal Fluid, and the Pia Mater.

CEREBRAL DURA MATER.

- 149 **Shape.** The Dura Mater has the shape of an irregular sac. The **External Surface** adheres closely to the bones;—it presents the branches of the middle meningeal artery. The **Internal Surface** is pearl-like;—it is lined by the arachnoid.

It presents the cerebral falx, the cerebellar falx, the tentorium.

It presents also the sinuses of the dura mater, which are the superior longitudinal, the inferior longitudinal, the straight, the posterior occipital, the lateral sinuses, the anterior occipital or transverse,—the inferior petrosal, the superior petrosal, the cavernous and the circular.

Structure. The dura mater is composed:—1st, of an *External layer* corresponding to the periosteum;—2d, of a *Middle purely fibrous*;—3d, of an *Internal or Serous layer* corresponding to the arachnoid.

CEREBRAL ARACHNOID.

- 150 **Shape.** The Cerebral Arachnoid is a shut sac. The **External Surface**, on the *parietal portion*, lines the dura mater;—on the *visceral or cerebral* portion it is separated from the pia mater by areolar tissue and the cerebro-spinal fluid;—it passes over the sulci and eminences of the brain like a bridge. The **Internal Surface** is reflected upon itself. The **Cavity of the Arachnoid** contains no fluid.

CEREBRAL SUB-ARACHNOID SPACE AND
CEREBRO-SPINAL FLUID.

- 151 **Shape.** Is a fluid layer in which the brain and spinal cord float.

CEREBRAL PIA MATER.

- 152 **Shape.** The Cerebral Pia Mater resembles an irregular sac. The **External Surface** is in contact with the sub-arachnoid areolar tissue and fluid. The **Internal Surface** is in relation with the cortical substance of the brain.—It dips down between the convolutions. **Structure.** The pia mater is formed essentially of the finest capillaries, held together by very delicate fibres of connective tissue.

The **Base** is turned downwards and projects beyond the isthmus.

The **Internal Surface** is in relation with the trachea, the cricoid and thyroid cartilages and the recurrent laryngeal nerve.

- 145 **Structure.** The thyroid body is composed:—1st, of an *External or Fibrous Coat*;—2d, of a *Proper Tissue* composed of alveoles resembling closed spaces or *vesicles* lined by a single layer of cells and filled with a granular fluid.

THYMUS.

- 146 **Shape.** The thymus consists of a pair of unequal lateral lobes, sometimes connected by a short isthmus.

The **Anterior Surface** is in relation with the sternum.

The **Posterior Surface** is in relation with the aorta, the pulmonary artery, the pericardium, the left innominate vein and the trachea.

Structure. The thymus is composed:—1st, of an *External or Fibrous Coat*;—2d, of a *Proper Tissue* divided into *hollow lobules* attached to a *hollow stem*;—the walls of the lobules are formed of a *Cortical* and a *Medullary* portion.—Both portions are composed of *alveoles* containing *lymphoid cells* and peculiar concentric bodies.

- 147 **Peculiarities of the Thyroid Body.**

Its color is peculiar.

Its shape also: two lobes and an isthmus (like the thymus).

It presents the peculiar pyramidal process.

The adhesion of the isthmus to the trachea is peculiar.

Its structure is peculiar, as presenting closed vesicles lined by a single layer of cells and filled with a granular fluid.

It has five arteries of good size.

They strike the organ at the angles.

Peculiarities of the Thymus.

The older the subject the smaller the organ.

The situation is peculiar.

Its irregular shape is peculiar; sometimes it presents two lobes united by a sort of isthmus.

Its structure is unique: hollow lobules attached to a hollow stem.

However, the structure of the walls of the lobules is fundamentally the same as the other lymphoid organ (a cavity is found also in the supra-renal capsules; also in the pituitary body; vesicles are found in the thyroid body).

MEMBRANES OF THE BRAIN.

- 148 **Enumeration.** The Brain is surrounded by the Dura Mater, the Arachnoid, the Sub-arachnoid Space with the Cerebro-spinal Fluid, and the Pia Mater.

The **Anterior Border or Extremity** is continuous with the optic nerves,—it closes in front the cavity of the brain ;—it presents the *anterior angles or horns*, which are prolongations of the lateral ventricles.

The **Posterior Border or Extremity** is free ; it leaves the cavity of the brain open beneath it.—It presents the *posterior angles or horns*, which are prolongations of the lateral ventricles.

The **Under Surface** is concave.—It adheres to the trigone or fornix in the middle,—on the sides it forms the roof of the lateral ventricles.

The **Lateral Borders** pass downwards and inwards into the white substance of the hemispheres.—They present the *lateral angles or horns*, which are also prolongations of the lateral ventricles.

Structure. The callous body is composed of transverse white fibres.

CAVITIES OF THE CEREBRUM.

- 156 **Boundaries and Divisions.** The interior of the cerebrum presents a large cavity bounded below by the base of the cerebrum, above by the callous body, and laterally by the hemispheres.

This large cavity is subdivided by two transverse septa, represented by the trigone and interposed veil, into a lower story called the middle or third ventricle, and into an upper story which is itself subdivided into two lateral halves by the pellucid septum and the trigone, called the two lateral ventricles of the cerebrum.

TRIGONE OR FORNIX.

- 157 **Shape.** The trigone is triangular when seen from above. The **Upper Surface**—in the *middle* is adherent to the callous body and pellucid septum ;—on the *sides* it forms a part of the floor of the lateral ventricles.

The **Borders** are attached to the interposed veil and to the optic beds.

The **Apex** presents the two *anterior pillars* which limit in front the foramen of Monro,—they terminate in the white bodies, or *corpora albicantia*.

The **Base** presents the two *posterior pillars* which curve forward into the lateral horns.

The **Under Surface** is broad behind and narrow in front.—It is in relation with the interposed veil and forms with it the roof of the middle ventricle.

Structure. Is composed of white substance throughout.

THE INTERPOSED VEIL.

- 158 **Shape.** The Interposed Veil is triangular.
 The **Upper Surface** is attached to the trigone and forms in part the floor of the lateral ventricles.
 The **Lateral Borders** are attached to the optic beds.
 The **Apex** sends a process through each foramen of Monro.
 The **Base** is continuous with the pia mater.
 The **Under Surface** presents the choroid plexus and the veins of Galen.
Structure. It has the same structure as the pia mater.

PELLUCID SEPTUM.

- 159 **Shape.** The Pellucid Septum is triangular.
 The **Lateral Surfaces** form the inner walls of the lateral ventricles.
 The **Upper Border** is attached to the under surface of the callous body.
 The **Lower Border** is attached to the trigone.
 The **Base** is attached to the anterior extremity of the callous body.
 The **Apex** occupies the angle formed by the callous body and the trigone.
Structure. The pellucid septum encloses a small cavity called the *Septal Ventricle* or *Fifth Ventricle*,—the inner walls of which are lined with grey matter;—the outer walls are formed of white substance.—The cavity sometimes communicates with the middle ventricle by the *Aqueduct of Vieussens* or *Winslow*.

LATERAL VENTRICLES.

- 160 **Shape.** The Lateral Ventricles are flattened from above downwards.
 The **Upper Wall or Roof** is formed by the callous body.
 The **Lower Wall or Floor** is formed by the trigone and the interposed veil resting on the optic beds.
 The **Inner Wall** is formed *behind* by the adhesion of the trigone to the callous body and *in front* by the pellucid septum.
 The **Outer Wall** is formed by the intra-ventricular portion or nucleus of the *Striated Body*.—It gives rise to the *Middle Horn*, which is the longest and which curves forward and inward into the sphenoidal lobe;—Its floor presents the *Great Hippocampus*, presenting along its inner border the *fimbriated body* and the *dentated band*;—the floor presents also another small eminence, the *Small Hippocampus*.
 The **Anterior Extremities** of the lateral ventricles are the *Anterior Horns*.

The **Posterior Extremities** are the *Posterior Horns*.

Structure. The Striated Bodies are composed of two lenticular nuclei separated by the diverging fibres of the cerebral peduncles;—below are found the *tonsillar nucleus* and the *claustrum*.

The *Hippocampus* is an inverted convolution with the grey substance in the centre.

MIDDLE VENTRICLE.

- 161 **Shape.** The Middle Ventricle is funnel-shaped and flattened laterally.

The **Upper Surface or Roof** is formed by the interposed veil and trigone.

The **Lower Surface or Floor** is formed by the chiasma, the infundibulum, the white bodies, the posterior perforated space and the cerebral peduncles.

The **Anterior Surface or Wall** is formed by the callous body, the anterior pillars of the trigone and the anterior white commissure.

The **Posterior Surface or Wall** presents the orifice of the aqueduct of Sylvius—and the posterior white commissure.

The **Lateral Surfaces or Walls** are formed by the *Optic Beds*, which are lined with grey matter and present the grey commissure,—the anterior tubercle,—the posterior tubercle—and the internal and external geniculate bodies—connected with the quadrigeminal bodies.

Structure. The Optic Beds are lined on their free surface by grey matter and contain also a mass of grey matter traversed by the fibres of the cerebellum.

PINEAL GLAND.

- 162 **Shape.** The Pineal Gland is conical.

The **Upper Surface** is in relation with the pia mater and the posterior border of the callous body.

The **Base** gives attachment to the peduncles of the pineal gland.

The **Apex** is turned backwards and is free.

The **Under Surface** is in relation with the quadrigeminal bodies.

Structure. The pineal gland is composed chiefly of grey matter; it has a small cavity often containing sandy matter.

QUADRIGEMINAL BODIES.

- 163 **Shape.** The *Anterior* or *Nates* are oblong;—the *Posterior* or *Testes* are hemispherical bodies.

The **Surfaces** are smooth.

The **Internal and External Extremities** are connected with the geniculate bodies.

Structure. The quadrigeminal bodies are formed of white substance enclosing a little grey matter.

CEREBELLUM.

- 164 **Shape.** The cerebellum is oblong and flattened from above downwards.

The **Under Surface** presents laminæ and grooves.

It presents on the *middle line*, the valley, the inferior vermiform process with the nodule, the uvula, pyramid, furrowed bands, the valves of Tarini and the swallow's nest.

It presents *on the sides*, the hemispheres, the posterior, middle and anterior lobe, the tonsillated lobules and the flocculus.

The **Circumference** of the *Cerebellum* presents behind a notch to receive the falx—and on the sides a deep horizontal fissure.

The **Upper Surface** presents also laminæ and grooves,—the superior vermiform process,—the valve of Vieussens,—the superior peduncles of the cerebellum,—the hemispheres of the cerebellum.

- 165 **Structure.** The surface of the cerebellum is composed of grey matter—and the interior of white substance mostly.—However, it contains in its interior a capsule of grey matter called the *dentated body*.—The arrangement of the grey matter as viewed upon a section is that of a tree, the *arbor vitæ*.

The *grey matter of the laminæ* comprises an external grey layer of molecular matter,—a middle layer of ganglionic cells of Purkinje,—of an internal rust layer,—a nuclear layer,—and of abundant arborescent capillaries.

VAROLIAN BRIDGE.

- 166 **Shape.** The Varolian Bridge is a quadrilateral white body. The **Anterior Surface** is convex;—it presents a groove for the basilar artery;—it is in relation with the basilar process of the occipital bone.

The **Lateral Surfaces** give origin to the middle peduncles of the cerebellum.

The **Upper Surface** is connected with the cerebral peduncles. The **Under Surface** is connected with the oblong medulla. The **Posterior Surface** forms the upper part of the floor of the cerebellar ventricle.

Structure. The Varolian Bridge is composed of alternate layers of grey and white substance, containing vertical and transverse fibres.

OBLONG MEDULLA.

- 167 **Shape.** The Oblong Medulla is pyramidal.
 The **Anterior Surface** presents the anterior median fissure,—the pyramidal body,—the olivary body,—the groove of origin of the hypoglossal nerve,—the arciform fibres—and the lateral tract.
 The **Lateral Surfaces** present the restiform bodies.
 The **Posterior Surface** presents the lower portion of the floor of the cerebellar ventricle,—the posterior median fissure,—the posterior pyramids.
 The **Base** is continuous with the Varolian Bridge.
 The **Apex** is continuous with the spinal cord.
- 168 **Structure.** The *Grey Substance* of the oblong medulla is situated on the floor of the cerebellar ventricle, in the olivary bodies and at the bottom of the lateral tract.—The olivary bodies contain a *dentated body*.
 The *White Substance* is composed of longitudinal and transverse fibres and of the arciform fibres.
 The anterior pyramids decussate partially.

CEREBELLAR VENTRICLE.

- 169 **Shape.** The Cerebellar Ventricle, or Fourth Ventricle, is lozeng-shaped.
 The **Upper Surface or Roof** is formed above by the valve of Vieussens, the superior peduncles of the cerebellum and the under surface of the cerebellum,—which itself presents the nodule, the uvula and the tonsils;—below it is formed by the reflected pia mater and arachnoid.
 The **Anterior Surface or Floor** is formed above by the posterior surface of the Varolian Bridge and below by the oblong medulla.—It presents the posterior median fissure, grey matter, transverse white fibres, the calamus scriptorius.
 The **Upper Angle or Extremity** presents the aqueduct of Sylvius.
 The **Middle or Lateral Angles** present the point of exit of the fibres of origin of the auditory nerve.
 The **Lower Angle or Extremity** presents an opening formed by the reflected pia mater and arachnoid.

EPENDYMA.

- 170 **Definition.** The Ependyma is the delicate transparent serous membrane lining all the ventricles.

COMMUNICATION OF THE VENTRICLES.

- 171 1st. The **Septal Ventricle** sometimes communicates with the middle ventricle by the aqueduct of Vieussens;—the Middle Ventricle communicates with the Lateral by the for-

amen of Monro;— also with the Cerebellar ventricle by the aqueduct of Sylvius.

2d. **The Lateral Ventricles** communicate with the anterior sub-arachnoid space through the transverse fissure of the brain; the Cerebellar communicates with the posterior sub-arachnoid space through the opening of the lower angle.

PECULIARITIES OF THE CENTRAL ORGANS OF INNERVATION.

172 Peculiarities of the Cerebral Dura Mater.

Its pearl-like color is remarkable.

Its shape is noticeable.

Also its loose adhesion to the bones of the vertex and its strong attachment to the bones of the base.

The presence of the large Middle Meningeal Artery is noticeable.

It is lined by a serous membrane (like the pericardium).

The processes called the falx and the tentorium are unique.

Also the numerous venous sinuses.

The sinuses are all at the base except the superior and inferior longitudinal.

The Cavernous Sinus is traversed by the internal carotid and several nerves.

They communicate with the extra cranial veins at several points.

Its purely fibrous structure, lined by a serous membrane, is noticeable.

Peculiarities of the Cerebral Arachnoid.

It passes over the sulci like a bridge.

It forms subserous spaces.

It contains no fluid.

Peculiarities of the Cerebro-Spinal Fluid.

It is unique.

It is rendered necessary because the brain is encased in an unyielding bony case; this in its turn is rendered necessary because of the exposed situation of the brain.

Peculiarities of the Cerebral Pia Mater.

It is the analogue of the periosteum of bones.

It dips down between the convolutions.

It penetrates into the brain and forms the interposed veil.

Its structure is remarkable.

173 Peculiarities of the Cerebrum.

Its grey color is peculiar,— also the white color of most parts.

Its shape is unique.

Also the longitudinal fissure, the hemispheres, the convolutions, the sulci.

Its sylvian fissure and the division of each hemisphere into lobes recalls that of the lungs.

Its base is the most important and noticeable part, because there we find the peculiarities and the large nerves and vessels.

The Island of Reil, at the bottom of the sylvian fissure, is unique.

The presence of the large Ganglionic Cells of Purkinje are peculiar.

The Arteries form the Circle of Willis and are found at the base.

No large arteries penetrate its tissue: they first break up in the pia mater.

The Veins of the surface discharge into the Superior Longitudinal Sinus.

Those of the interior into the Straight Sinus.

The Capillaries of the convolutions present a characteristic arborescent arrangement.

Peculiarities of the Peduncles of the Cerebrum: are unique.

Peculiarities of the Callous Body: are unique.

However, it may be considered as an isthmus joining two lobes.

The absence of grey matter in its substance is noticeable.

174 The **Peculiarities of the Cavities of the Cerebrum.**

They correspond to those of the heart.

The communication with the surface is through the transverse fissure.

This transverse fissure is the only opening.

The presence in these cavities of masses of grey matter (the striated bodies and the optic beds) is remarkable.

The separation of these cavities by the trigone, the interposed veil, the pellucid septum is unique.

The presence of a cavity in the septum is unique.

The lateral Horns of the Lateral Ventricles winding around the peduncles are noticeable.

175 **Peculiarities of the Pineal Gland.**

It is unique.

Its cavity containing sandy matter is unique.

Peculiarities of the Quadrigeminal Bodies.

They are also unique.

Their connection with the optic beds is noticeable.

Peculiarities of the Cerebellum.

Its size is remarkable.

Its color also.

Also its peculiar shape.

Also some of its peculiarities: specially the valves of Tarin, the swallow's nest, the peduncles, the valve of Vieussens.

The lamellæ replacing here the convolutions are noticeable.

They have the same structure and the same capillaries as the convolutions.

The presence of the Arbor Vitæ and of the dentated body is peculiar.

Peculiarities of the Varolian Bridge.

It is unique.

Its situation at the junction of the other parts of the brain which it unites is remarkable.

Its white color is noticeable.

The direction of its fibres in its substance is noticeable.

The large Basilar artery resting on it is to be noted.

Peculiarities of the Oblong Medulla.

Its white color is peculiar (like varolian bridge, cerebral peduncles).

Its size, the smallest of all the parts of the brain, is to be noted.

The origin from it of numerous most important nerves is noticeable.

The decussation of its fibres is unique.

Peculiarities of the Cerebellar Ventricle.

Its situation between the Varolian Bridge and the Oblong Medulla is peculiar.

Its size also is peculiar.

Its shape, lozenge-shape, is remarkable.

The presence of grey matter on its floor is noticeable.

Also the origin there of the auditory nerves.

176 **The Communication of the Ventricles.**

They communicate between themselves and with the exterior of the brain, through the Aqueduct of Winslow, the foramen of Monro, the Aqueduct of Vieussens, the Transverse Fissure of the brain and the lower angle of the cerebellar ventricle.

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MEMBRANES OF THE SPINAL CORD.

- 177 **Enumeration.** The envelopes of the spinal cord are the Dura Mater, the Arachnoid, the Cerebro-spinal Fluid and the Pia Mater.

DURA MATER OF THE SPINAL CORD.

- 178 **Shape.** The dura mater of the spinal cord has the shape of a long tube.

The **External Surface** is unattached to the periosteum.—It gives attachment to the *dentated ligament* of the cord.

The **Upper Extremity** is attached to the occipital foramen.

The **Lower Extremity** is closed and is attached to the sacrum.

Structure. It is composed of simple fibrous tissue.

ARACHNOID OF THE SPINAL CORD.

- 179 **Shape.** The arachnoid of the cord resembles a long double tube.
 The **External Surface** lines the dura mater and is then reflected upon the cord.
 The **Internal Surface** is reflected upon itself.
 The **Upper Extremity** is continuous with the cerebral arachnoid.
 The **Lower Extremity** forms a closed bag around the mare's tail.
Structure. It is a purely serous membrane.

CEREBRO-SPINAL FLUID.

- 180 The **Cerebro-spinal Fluid** forms a regular layer around the cord, specially during the arterial diastole of the brain.

PIA MATER OF THE SPINAL CORD.

- 181 **Shape.** The Pia Mater of the spinal cord has the shape of a tube.
 The **External Surface** gives off the *dentated ligament* to the dura mater—and sends off a prolongation or sheath around each nerve.—It is in relation with the sub-arachnoid areolar tissue and the cerebro-spinal fluid.
 The **Internal Surface** adheres intimately to the cord, which seems compressed by it.
 The **Upper Extremity** is continuous with the pia mater of the brain.
 The **Lower Extremity** presents the *coccygean ligament*.
Structure. *It is more* fibrous and less vascular than the cerebral pia mater.

SPINAL CORD.

- 182 **Shape.** The Spinal Cord is cylindrical with a cervical and a lumbar enlargement.
 The **Posterior Surface** presents the posterior median fissure,—the posterior white commissure,—the posterior columns (or postero-lateral columns).
 The **Lateral Surfaces** present the antero-lateral fissure,—the lateral columns,—the postero-lateral fissure.
 The **Upper Extremity** is continuous with the oblong medulla—it presents the neck;—it corresponds to the occipital foramen.
 The **Lower Extremity** is pointed;—it gives attachment to the *caudal ligament*.
 The **Anterior Surface** presents the anterior median fissure,—the anterior white commissure,—the anterior columns of the spinal cord.

- 183 **Structure.** The spinal cord is composed externally of *white substance*.

Internally, of *grey substance*, having the shape of *two crescents* united, by a transverse grey band;— the extremities of the crescents are called the *horns* and correspond to the origin of the nerves;— the anterior horns have large multipolar cells— and the posterior horns small multipolar cells;— the processes all communicate with one another and with the fibres of the white substance.

- 184 **Peculiarities of the Dura Mater of the Spinal Cord.**

Its shape is peculiar— that of a long tube.

It is unattached to the bones except at the foramens.

It presents the peculiar dentated ligament.

Peculiarities of the Arachnoid of the Spinal Cord.

Its shape is peculiar; that of a long tube.

It forms a closed bag around the mare's tail.

Peculiarities of the Cerebro-Spinal Fluid.

Is only present during the arterial diastole of the brain.

Peculiarities of the Pia Mater of the Spinal Cord.

Its shape is peculiar.

It presents the dentated ligament and the caudate ligament.

It seems to constrict the cord.

It is more fibrous and less vascular.

- 185 **Peculiarities of the Spinal Cord.**

It is unique.

Its color is peculiar.

Its length also; it stops at the second lumbar vertebra.

Its shape is peculiar.

Its grooves and fissures are peculiar,— specially the respiratory tract in the cervical region.

The presence of the Caudate Ligament is peculiar.

Its structure is unique.

The White matter is on the outside.

The Grey matter is in the interior and forms two crescents joined by a transverse band.

The arrangement of the nerve cells is peculiar.

No large artery penetrates its substance.

The Capillaries are characteristic.

NOSE.

- 186 **Shape.** The nose is a pyramidal eminence.

The **Anterior Border** is called the *bridge* between the eyes, and below the *back*.

The **Lateral Surfaces** are inclined outwards.

The **Lateral Borders** are separated from the cheek by the naso-orbital groove.

The **Upper Extremity** is the *Root*.

The **Lower Extremity** presents the tip or lobule,—the wings,—the nostrils,—and the column or septum of the nose.

The **Posterior Surface** is concave—and is turned towards the nasal cavities;—it gives attachment to the septal cartilage and ethmoidal plate.

- 187 **Structure.** The Nose is composed:—1st, of *Skin*;—2d, of *Muscles*, which are the pyramidal, the common elevator of the wing of the nose and of the upper lip, the nasal compressor or sphincter, the nasal dilator or transverse;—3d, of *Cartilages*, which are the septal, the upper lateral, the lower lateral, the ascending;—4th, of a *Fibrous Membrane* binding the cartilages together;—5th, of *Bones*, which are the nasal bones and ascending branch or nasal process of the upper maxilla;—6th, of *Mucous Membrane*.

NASAL CAVITIES.

- 188 **Shape.** The nasal cavities are prismatic and triangular. The **Inner Surface or Wall** forms the nasal partition;—It is formed by the triangular cartilage, vomer and ethmoid. The **Outer Surface or Wall** presents a flat surface,—the superior turbinated bone,—the superior meatus,—the middle turbinated bone,—the middle meatus with the opening of the antrum,—the inferior turbinated bone—and the inferior meatus, with the orifice of the nasal canal and the Eustachian tube.

The **Lower Surface or Floor** is formed by the maxillary and the palate bones.

The **Upper Surface or Roof** is formed by the cribriform plate.

The **Anterior Extremity** is formed by the anterior nares.

The **Posterior Extremity** is formed by the posterior nares.

- 189 **Structure.** The *Mucous Membrane* of the Nasal Cavities, or membrane of Schneider, lines all the structures;—it has a ciliated epithelium and racemose glands.

The filaments of the olfactory nerve do not extend below the superior turbinated bone;—they terminate in the *olfactory cells*, which are connected deeply with the axis cylinder of the nervous filaments and which give off towards the surface two or three fibrils which terminate in the epithelium.

- 190 **Peculiarities of the Nose.**

It is unique.

The nostrils are peculiar, being lined with skin.

The cartilaginous parts are noticeable.

There are no intermediate capillaries at the tip.

Peculiarities of the Nasal Cavities.

Their irregularity is peculiar.

Their communication with all the other cavities of the head is noticeable.

The epithelium of the mucous membrane is ciliated.

The Veins anastomose with the superior longitudinal sinus through the blind foramen.

It receives a nerve of special sense whose fibrils terminate by hair cells.

EYEBALL.

- 191 **Enumeration.** The Eyeball consists of the Cornea, Sclerotic, Choroid, Retina, Vitreous Body, Crystalline Lens, Iris, and Aqueous Humor.

CORNEA.

- 192 **Shape.** The Cornea is the segment of a sphere smaller than that of the sclerotic.
 The **Anterior Surface** is convex;—it is in relation with the lids.
 The **Circumference** seems beveled, so that it looks elliptical in front and circular behind.
 The **Posterior Surface** is concave;—it is in relation with the aqueous humor.
- 193 **Structure.** The cornea is composed:—1st, of a *Laminated Epithelial* layer;—2d, of an *Anterior Thin Elastic Lamina*;—3d, of *Fibres* continuous with those of the sclerotic, but forming lamellæ and alveoles containing fluid and the corneal corpuscles;—4th, of a *Posterior Thick Elastic Lamina*, forming at the margin the pectinate ligament of the iris;—5th, of a *Posterior Single Layer of Endothelial Cells*;—6th, it is deprived of blood vessels except at the margin.

SCLEROTIC.

- 194 **Shape.** The Sclerotic corresponds to about the four-fifths of a regular sphere.
 The **External Surface** is white;—it is in relation *in front* with the conjunctiva and the tendons of the straight muscles; *in the middle* with the four vorticosæ veins; *behind* with Tenon's capsule and the tendons of the two obliques.
 The **Internal Surface** is brown;—it is in relation with the choroid.
 The **Anterior Extremity** is continuous with the cornea.
 The **Posterior Extremity** presents an orifice with a cribriform membrane, through which the optic nerve is sifted, as it were.
Structure. The sclerotic is purely *Fibrous*, with numerous branching connective tissue corpuscles.

CHOROID.

- 195 **Shape.** The Choroid represents the segment of a sphere with the concavity turned forward.

The **External Surface** is of a light brown;—it presents grooves for the vessels and nerves;—it is in relation with the sclerotic.

The **Internal Surface** is of a deep brown;—it is loosely attached to the retina.

The **Anterior Extremity** presents:—1st, the choroid zone, which is deeper in color, is serrated and corresponds to the zone of Zinn;—2d, the ciliary ligament;—3d, the ciliary processes.

The **Posterior Extremity** is perforated by the optic nerve.

- 196 **Structure.** The choroid is composed:—1st, of an *External Layer* of connective tissue with irregular caudate pigment cells;—2d, of a *Venous Layer* presenting vorticoso capillaries;—3d, of an *Arterial and Nervous Layer* formed by the large ciliary arteries and by the ciliary nerves;—4th, of a *Capillary Layer* or membrane of Ruysch, presenting characteristic radiating anastomoses;—5th, of a *Vitreous Membrane* separating it from the retina.

RETINA.

- 197 **Shape.** The Retina resembles a segment of a sphere with the concavity turned forward.

The **External Surface** is in mere contact with the choroid.

The **Anterior Extremity** is serrated and adheres to the posterior border of the zone of Zinn.

The **Posterior Extremity** is continuous with the optic nerve.

The **Internal Surface** presents the transverse fold,—the yellow spot,—the blind foramen—and the papilla of the optic nerve, with the central artery and vein of the retina.

- 198 **Structure.** The retina is composed:—1st, of a *Stroma* forming the fibres of Muller;—2d, of a *Pigmentary layer*;—3d, of an *External Limiting Membrane*;—4th, of the *Layer of Rods and Cones*;—5th, of the *Outer Nuclear layer*;—6th, of the *Outer Granular layer*;—7th, of the *Inner Nuclear layer*;—8th, of the *Inner Granular layer*;—9th, of the *Layer of Ganglionic Cells*;—10th, of the *Layer of the Optic Nerve Fibres*.

At the *yellow spot*, the cones are few, the rods plentiful and large, the ganglionic cells form several layers.

VITREOUS BODY.

- 199 **Shape.** The vitreous body has the shape of a spheroid.

The **Anterior Surface** receives the lens.

It presents the *Zone of Zinn*, which corresponds to the

choroid zone and to the ciliary processes of the choroid.—The zone of Zinn divides into an anterior fine membrane attached to the anterior margin of the lens and a posterior fine membrane attached to the posterior margin.—Between the two membranes is the *beaded canal*.

The **Posterior Surface** presents depressions for the folds of the yellow spot and for the papilla of the optic nerve.

The **Middle Surface** is in relation with the retina, but is not adherent to it.

Structure. The vitreous body is composed of an external or *Hyaloid Membrane* and of alveoles in which the *Vitreous Humor* is deposited.

CRYSTALLINE LENS.

- 200 **Shape.** The Crystalline Lens is biconvex. The **Anterior Surface** is less convex than the posterior. It is in relation with the pupil and with the iris. The **Posterior Surface** is the more convex;—it is in relation with the fossa on the vitreous body. The **Circumference** is in relation by its *anterior lip* with the ciliary processes of the choroid, the zone of Zinn, the ciliary muscle, the point of union of the sclerotic, cornea and circular sinus;—by its *interstice* with the beaded canal;—by the *posterior lip* with the hyaloid membrane.
- 201 **Structure.** The crystalline lens are composed:—1st, of a *Capsule*;—2d, of the *Liquid of Morgagni*;—3d, of a *Cortical* and—4th of a *Central Portion or Nucleus*.—Both portions are composed of hexagonal fibres or tubes which form laminae separated by clear spaces called Meridians, and filled with homogeneous substance.

IRIS.

- 202 **Shape.** The Iris has the shape of a circular diaphragm, with an opening in the centre called the *pupil*. The **Anterior Surface** varies in color and presents a small and a large colored ring.—It presents also white or fibrous arcades and striæ.—It forms the posterior wall of the anterior chamber. The **Posterior Surface** is of a jet black.—It forms the anterior wall of the posterior chamber. The **Greater Circumference** is in relation with the pectinate ligament of the iris, the ciliary muscle and the ciliary processes of the choroid. The **Small Circumference of Pupil** is circular and serrated.
- 203 **Structure.** The Iris is composed:—1st, of an *Anterior Serous Layer*;—2d, of an *Anterior Basement Membrane*;—3d, of a *Proper Tissue* composed of connective tissue with

pigmented corpuscles, of circular and radiating fibres;—4th, of a *Posterior Basement Membrane*;—5th, of a *Pigmentary Layer*;—6th, of a *Posterior Serous Layer*;—7th, of *Arterial Capillaries* forming a marginal and pupillary plexus;—8th, of *Capillary Veins* which open into the *circular sinus* situated at the point of union of the iris with the cornea and sclerotic.

AQUEOUS HUMOR.

- 204 **Shape.** The Aqueous Humor is enclosed in a shut sac called the membrane of the aqueous humor or membrane of Descemet.—It is divided by the iris into an anterior and a posterior chamber.

The **External Surface** of the membrane is firmly attached to the cornea, iris and lens.—It may be considered as forming the posterior elastic lamina of the cornea, the anterior and posterior basement membranes of the iris and the anterior capsule of the lens.

The **Internal Surface** is lined with a single layer of polygonal cells.

The **Liquid or Humor** itself is remarkable for its clearness and the rapidity of its reproduction.

ORBITAL FASCIA.

- 205 **Divisions.** The orbital fascia is composed:—1st, of a *Palpebral* portion, which corresponds to the lids;—2d, of a *Parietal* portion, which lines the walls of the orbit;—3d, of a *Muscular* portion, which forms sheaths around the muscles;—and 4th, of an *Ocular* portion, which is reflected behind the eyeball and forms Tenon's capsule.

MUSCLES OF THE EYEBALL.

- 206 The Muscles of the Eyeball are—the *Upper Straight* or elevator,—the *Lower Straight* or depressor,—the *Internal Straight* or adductor,—the *External Straight* or abductor,—the *Superior Oblique*, which turns the pupil outwards and downwards;—and the *Inferior Oblique* or sympathetic muscle, which turns the pupil outwards but upwards.

All the *straight muscles* originate from the optic foramen and sphenoidal fissure and are inserted into the anterior segment of the sclerotic.

The *Superior Oblique* originates from the sphenoidal fissure—and the *Inferior Oblique* from the orbital margin; *both* are inserted into the outer part of the posterior segment of the sclerotic.

All the muscles are supplied by the Common Ocular Motor, except the External Straight, which receives the

External Ocular Motor or sixth nerve, and the Superior Oblique, which receives the pathetic or fourth nerve.

EYELIDS.

- 207 **Structure.** The Eyelids are composed:—1st, of a *Cutaneous* layer;—2d, of a *Muscular* layer formed by the orbicular;—3d, of a *Fibro-Cartilaginous* layer formed by the two tarsal cartilages and the broad ligament;—4th, of a *Tendinous Layer* in the upper lid only, formed by the expanded tendon of the elevator muscle of the upper lid;—5th, of a *Mucous Layer* or conjunctiva forming the caruncula, the semilunar folds and the lachrymal lake;—6th, of *Glands* which are the glands of the skin (sweat and sebaceous), the glands of the free margin (which are the ciliary glands on the anterior lip and the Meibomian glands on the posterior lip and the caruncula),—the glands of the conjunctiva, which are simple racemose glands.

EYEBROWS.

- 208 **Structure.** The Eyebrows are formed:—1st, of Hairs;—2d, of Skin;—3d, of the Superciliary Muscle;—4th, of the Superciliary Eminence of the Frontal Bone.

LACHRYMAL APPARATUS.

- 209 **Enumeration.** The tears are secreted by the *Lachrymal Glands*, situated in the upper and outer part of the orbit and lid;—they are discharged through fine *Excretory Ducts* on the outer part of the upper eyelid.

The *Orbicular Muscle* spreads them over the cornea, and at the same time directs them towards the *Lachrymal Lake* at the internal angle of the eye.

They are absorbed there by the *Lachrymal Points*,—and conducted into the *Lachrymal Canals*, which are situated in the substance of the two direct tendons of the orbicular.—They are then discharged into the *Lachrymal Sac*, the outer wall of which is membranous,—and then into the *Nasal Canal* and the *Inferior Meatus*.

- 210 **Peculiarities of the Eyeball and Envelopes.**

Is unique.

Peculiarities of the Cornea.

Is irregular.

Its continuation with the sclerotic is unique.

The presence of the Elastic Laminæ is peculiar.

The Corpuscles are noticeable (like bone, cement, tendon, connective tissue).

The fluid between the meshes is remarkable (like the vitreous body).

The absence of capillaries is remarkable.

Peculiarities of the Sclerotic.

It is peculiar for its color (like the albugineous of testicle).

Also its shape (like a shell).

The insertion of muscles to it is unique.

The perforations for the vorticose veins are unique.

The perforation for the optic nerve also.

Its continuation with the cornea is unique.

The brown color of the inner surface is unique.

Its unyielding structure is remarkable.

Peculiarities of the Choroid.

It is peculiar for its color (like the iris).

Also for presenting the choroid zone.

Also the ciliary Processes.

Also the ciliary ligament.

Its clean cut perforation by the optic nerve is noticeable.

The difference in the outer and inner pigment cells is remarkable.

Its great vascular structure is rare (like the iris).

The Arteries are the very numerous posterior short ciliaries.

The Veins form the peculiar unique Vorticose Veins.

The Capillaries form a special membrane, the membrane of Ruysch, whose vessels are stellate.

The Nerves are abundant.

Peculiarities of the Retina.

It is peculiar by its color in the dead.

Also its thorough transparency in the living.

Its thinness is noticeable.

Its anterior serrated extremity is unique.

Its continuation behind with the optic nerve is unique.

Also the optic papilla with the vessels emerging from it.

Also the transverse fold and the yellow spot.

Also the numerous layers, specially considering the thinness of the membrane.

The Stroma is peculiar and unique (like the spinal cord).

Also its pigmentary layer (as in the choroid).

Also its limiting membranes (as in dermis and cornea).

Also its layers of Rods and Cones, unique.

Also the nuclear layers (as in cerebellum).

Also the Ganglionic Cells.

Also the layers of the Optic Nerve Fibres.

The Central Artery and Veins are unique.

211 Peculiarities of the Vitreous Body.

It is unique (it recalls the cornea).

Its consistency is unique.

The Zone of Zinn is peculiar.

Also the Beaded Canal.

Also its structure recalling the Cornea and the tissue of the umbilical cord.

Also the absence of vessels in the adult.

Peculiarities of the Crystalline Lens.

It is unique.

Also is its shape.

Also numerous and important organs near its circumference.

Its structure is unique.

Its capsule is unique.

Its fibres are unique.

Its meridians are unique.

The central portion is the harder, whereas usually it is the softer.

The absence of nerves and vessels is peculiar.

Peculiarities of the Iris.

It is a unique organ.

The variation of color of the anterior surface is unique.

The permanence of color of the posterior surface is noticeable.

The pupil is unique.

The muscular fibres are peculiar.

The Arteries are numerous; long ciliary, anterior short ciliary.

The Veins open in the peculiar circular sinus.

The Capillaries form two rings.

The Nerves come from a ganglion, the ophthalmic

Peculiarities of the Aqueous Humor.

It is unique — (resembles the endolymphs, the cerebro-spinal fluid).

The rapidity of its reproduction is unique (as the cerebro-spinal fluid).

PECULIARITIES OF THE APPENDAGES OF THE EYE.

212 **Peculiarities of the Orbital Fascia.**

Is unique as an apparatus of suspension.

Tenon's Capsule is peculiar.

Peculiarities of the Muscles of the Eyeball.

They are peculiar because all (excepting one) originate from the same spot.

The Four Straight are peculiar because they are inserted in the anterior segment regularly around the cornea.

The Two Oblique are peculiar in being inserted on the posterior segment and on its outer part.

The Great Oblique is noticeable because it is the only muscle reflected through a regular pulley.

The Small Oblique is peculiar in being coiled as it were around the eyeball.

The Nerves of these Muscles are peculiar in their distribution.

The filaments to the iris are peculiar.

Peculiarities of the Eyelids.

Are unique.

Their skin is remarkable for its thinness (as in the penis).

The Tarsal Cartilages are unique.

The Broad Ligament is unique, dividing the lids into two distinct layers (like Tenon's Capsule).

The termination of the Tendon of the Elevator Muscle of the Eyelid is unique.

The Mucous Layer is peculiar in forming the semilunar fold and the lachrymal lake.

The Caruncula is unique.

The Meibomian Glands are peculiar (like the Ceruminous).

The Veins behind the broad ligament form the Ophthalmic vein.

The Veins in front form the facial vein.

The Lymphatics behind discharge into the deep glands.

Those in front into the parotid and the submaxillary glands.

Peculiarities of the Eyebrows.

Are unique.

Peculiarities of the Lachrymal Apparatus.

Is also unique.

The Gland has two portions.

The Excretory ducts are multiple (as in the sublingual, prostate).

The Lachrymal Lake is unique.

Also the Lachrymal Points.

Also the Lachrymal Ducts.

The Lachrymal Sac is noticeable (like the gall bladder, urinary bladder, seminal vesicles).

The Nasal Canal is remarkable.

The purely mechanical uses of the secretions is noticeable.

ORGANS OF HEARING.

- 213 **Enumeration.** The organs of hearing are composed of the *External Ear*, comprising:—1st. the Pavilion and External Auditory Canal;—2d, the *Middle Ear*, comprising the tympanum and the Chain of Ossicles, the Mastoid Cells and the Eustachian Tube;—3d, the *Internal Ear*, comprising the Vestibule, the Semi-circular Canals and Cochlea, each having a bony, a membranous and a liquid portion;—4th, the *Internal Auditory Canal* lodging the Auditory Nerve.

PAVILION OR AURICLE.

- 214 **Shape.** The pavilion is oval;—it resembles the expanded end of a trumpet crushed inwardly.
The **Surfaces** present the helix,—the fossa of the helix,—

the anti-helix,—the fossa of the anti-helix,—the concha,—the tragus,—the anti-tragus—and a notch.

The **Upper Extremity** or *Base* is rounded.

The **Lower Extremity** or *Apex* forms the lobule.

- 215 **Structure.** The pavilion is composed:—1st, of a *Cutaneous* layer;—2d, of a *Fibro-elastic Cartilage* forming the bulk of the pavilion;—3d, of *Intrinsic Muscles*, which are the great muscle of the helix, the small muscle of the helix, the muscle of the tragus, the muscle of the anti-tragus, the transverse muscle;—4th, of the *Extrinsic Muscles*, which are the anterior auricular, the superior auricular and the posterior auricular.

EXTERNAL AUDITORY CANAL.

- 216 **Direction.** The External Auditory Canal is directed inwards and forwards;—it also curves upwards and then downwards.

Shape. The External Auditory canal, at its beginning, is oval;—in the middle it is slightly flattened.

The **Anterior Surface** is in relation with the parotid and lower maxilla.

The **Posterior Surface** is in relation with the mastoid process.

The **Upper Border** is convex and smooth.

The **Lower Border** is concave as a whole but presents the projection of the tragus.

The **Outer Extremity** is continuous with the pavilion.

The **Inner Extremity** is in relation with the tympanum.

- 217 **Structure.** The external auditory canal:—1st, is lined throughout with *Skin* presenting the *Ceruminous Glands*;—2d, the *Inner Portion* is osseous and formed by the temporal bone;—3d, the *Outer Portion* is formed of a cartilaginous gutter below and of a membranous portion above, like the trachea.

TYMPANUM OR DRUM OF THE EAR.

- 218 **Shape.** The Drum of the Ear is irregularly circular or flattened.

The **Outer Wall** is formed by the *Tympanic Membrane*, often called simply the tympanum;—it is connected with the mallet and anvil.

The **Inner Wall** presents the promontory,—the apex of the osseous canal of the tensor muscle of the mallet,—the oval window corresponding to the vestibule,—the round window corresponding to the cochlea,—the pyramid lodging the stapedius muscle,—and the ridge of the Fallopian canal situated above the oval window.

The **Anterior Wall** presents the orifice of the Eustachian tube.

The **Posterior Wall** presents the orifice leading into the mastoid cells.

The **Upper Wall or Roof** is formed by a thin plate of bone separating the Tympanum from the cranial cavity.

The **Lower Wall or Floor** presents the glenoid fissure lodging the cord of the Tympanum and the Laxator Muscle of the mallet.

OSSICLES OF THE TYMPANUM.

- 219 **Shape.** The Ossicles of the Tympanum are named, after their shape, the *Mallet*, the *Anvil*, the *Lenticular Bone* and the *Stirrup*.

They form an *irregular chain* from the tympanic membrane to the oval window which is closed by the stirrup.

Ligaments. They are held together and are fastened to the surrounding structures by various ligaments.

Muscles. The muscles which act upon them are the *Tensor Muscle* (of the mallet), the *Muscle of the Stirrup*, the *Large Laxator Muscle* (of the mallet) and the *Small Laxator Muscle* (of the mallet).

LINING MEMBRANE.

- 220 The tympanum is lined by a mucous membrane, which is the prolongation of the pharyngeal mucous membrane through the Eustachian tube;—it is prolonged into the mastoid cells.

MASTOID CELLS.

- 221 The mastoid cells are irregular cavities in the substance of the mastoid process — communicating with the tympanum — and lined by a mucous membrane, which is a continuation of the membrane of the tympanum.

EUSTACHIAN TUBE.

- 222 **Direction.** The Eustachian tube is directed obliquely inwards, forwards and downwards.

Shape. The Eustachian tube on a longitudinal section resembles two cones joined at their apices near the centre of the canal.

The **Surfaces** are in relation with the parotid gland.

The **Outer Extremity** opens on the lower part of the wall of the tympanum.

The **Inner Extremity** opens by an expanded orifice on the side of the pharynx.

- 223 **Structure.** The *inner three-fifths* are composed of a grooved cartilaginous portion below, and of a membranous portion above. The *outer two-fifths* are formed of osseous

tissue.—Both portions are lined with a mucous membrane, which is continuous with that of the pharynx.

224 Relative Position of the Parts Composing the Internal Ear.

The *Vestibule* is between the tympanum and the internal auditory canal.—The *Semi-circular Canals* are situated above the vestibule.—The *Cochlea* is situated in front of the vestibule; its base corresponds to the bottom of the internal auditory canal.

VESTIBULE.

225 Shape. The Vestibule is irregularly oval.

The **Surfaces or Walls** present the crest of the vestibule,—the pyramidal eminence presenting the *Inferior Cribri-form Spot*,—the hemi-elliptical fossa,—the sulciform fossa,—the orifices of the semi-circular canals, one of which presents the vestibule,—the orifice of the *Superior Cribri-form Spot*,—the orifice of the aqueduct of the vestibular scala of the cochlea,—the oval window corresponding to the stirrup and to the tympanum,—the round window or orifice of the tympanic scala of the tympanum.

226 Structure. The vestibule is composed:—1st, of bony walls distinct from the petrous bone;—2d, of a delicate periosteum lining of the walls;—3d, of a liquid layer called the *perilymph*;—4th, of a membranous layer formed of a delicate membrane moulded on the bony walls and in which the vestibular branches of the auditory nerve terminate opposite the cribriform spots; at that point are found the *otoliths*;—5th, of a liquid contained in its interior and called the endolymph.

SEMI-CIRCULAR CANALS.

227 Shape. The Semi-circular canals represent each more than half of a circle.

The **Surfaces or Walls** are in relation with the surrounding bony tissue.

The **Extremities** open into the vestibule.

228 Structure. The Semi-circular canals are composed:—1st, of bony walls distinct from the petrous bone;—2d, of a delicate periosteum lining these walls;—3d, of a liquid layer called the *perilymph*;—4th, of a membranous layer formed of a delicate membrane moulded on the bony walls;—5th, of a liquid contained in its interior and called the endolymph.

COCHLEA.

229 Shape. The Cochlea is Conical and resembles a snail.

The **Base** is applied to the bottom of the auditory canal.

The **Apex** is directed forwards and outwards.

The **External Surface** is in relation with the osseous tissue of the petrous bone.

The **Internal Surface** encloses a cavity divided by an osteo-membranous lamina into the *upper or tympanic scala*, the *middle or intra-membranous scala* and an *inferior or vestibular scala*.

- 230 **Structure.** The *Upper and Lower Scalae* are composed:—1st, of a bony wall;—2d, of a delicate periosteum;—3d, of a liquid called the perilymph;—4th, of a layer of cells corresponding to the outer surface of the membranous portion of the spiral lamina.

The *Middle Scala* is formed:—1st, of an upper and lower membranous wall;—2d, of a layer of lining cells;—3d, of a liquid called the endolymph;—4th, of cells called the supporting cells;—5th, of peculiar fibres called the pillars or fibres of Corti;—6th, of peculiar hair cells which are the termination of the fibrils of the auditory nerve.

INTERNAL AUDITORY CANAL.

- 231 **Direction.** The Internal Auditory Canal is directed obliquely downwards, forwards and outwards.

Shape. It is cylindrical.

The **External Surface** is in relation with the petrous bone.

The **Inner Surface** is lined by dura mater.

The **Internal or Cranial Extremity** is situated on the posterior surface of the petrous bone.

The **External Extremity or Bottom** presents above the orifice of the aqueduct of Fallopius for the facial nerve, and below the orifice for the vestibular and cochlear nerves.

- 232 **Structure.** The internal auditory canal is composed:—1st, of an osseous layer distinct from the petrous bone;—2d, of a fibrous layer formed by the dura mater;—3d, of a serous layer formed by the arachnoid.

PECULIARITIES OF THE ORGANS OF HEARING.

- 233 **Peculiarities of the Pavilion.**

Is unique excepting the Fallopian tube, which resembles it.

The irregularities of the surfaces are noticeable.

Its cutaneous and cartilaginous structure is peculiar (like the nose).

It is very vascular; when the cord of the tympanum is cut the capillaries become engorged.

Peculiarities of the External Auditory Canal.

Has a noticeable course.

The presence of the tympanic membrane at its internal extremity is unique.

The Ceruminous Glands are peculiar (like the Meibomians).

The structure of the canal, half fibro-cartilaginous and half osseous, is peculiar (like Eustachian tube, trachea).

Peculiarities of the Tympanum or Drum of the Ear.

It is unique.

The Tympanic Membrane is unique.

The Round and Oval windows with their membranes are unique.

The Chain of Ossicles, with their ligaments and muscles, are unique.

The thin plate of the upper wall is noticeable.

The presence of the Glenoid fissure and the cord of the tympanum are peculiar.

The Lining membrane coming from the Pharynx is remarkable.

It presents the peculiar nerve of Jacobson.

Peculiarities of the Mastoid Cells.

They are noticeable.

They resemble the ethmoid cells.

Peculiarities of the Eustachian Tube.

It is unique.

Its direction is noticeable.

Its shape also (two cones joined by their apices).

The opening into the pharynx is unique.

Its structure, half fibro-cartilaginous and half osseous, is noticeable (like the external auditory canal).

234 **Peculiarities of the Internal Ear.**

Is noticeable in all particulars.

Peculiarities of the Vestibule.

It is unique.

The cribriform spots are noticeable.

The presence of the perilymph, of the membranous vestibule, of the endolymph are peculiar to this internal ear.

The termination of the fibrils of the vestibular nerve and the otoliths is unique.

The fact that the bony walls of the vestibule, canal and cochlea are separate from the petrous bone is unique.

Peculiarities of the Semi-Circular Canals.

Are unique in all particulars.

The absence of nerve terminations is noticeable.

Peculiarities of the Cochlea.

It is unique.

Its shape is unique.

The base being applied to the bottom of the Internal Auditory Canal is noticeable.

The division of the interior into three scales is peculiar.

The fibres of Corti are peculiar.

The course and termination of the Cochlear nerve is peculiar.

Peculiarities of the Internal Auditory Canal.

It is unique.

The presence at the bottom of two large divisions is noticeable.

The presence in its interior of three nerves is noticeable.

The Auditory Nerve is a soft nerve.

The Petrous bone is traversed by the aqueduct of Fallopius lodging the facial nerve, which on its course gives off the peculiar cord of the tympanum.

SKIN.

- 235 **Layers.** The Skin is composed of the *Epidermis* and *Dermis*.

The Epidermis presents the following layers:—1st, the *Cuticle*, composed of flattened cells;—2d, the *Transparent Layer*, dimly striated;—3d, the *Granular Layer*, formed of flattened spindle-shaped cells;—4th, of the *Mucous Layer*, composed of soft, round or oval cells;—5th, of a *Layer of Pigmented Cells* in the negro;—6th, of a *Basement Membrane* separating the deepest cells of the mucous layer from the papillæ.

The Dermis presents:—1st, the *Papillary Layer*, formed of vascular and nervous papillæ, presenting the *Tactile Corpuscles*;—and 2d, the *Dermis Proper*, composed of connective tissue and a few smooth muscular fibres.

HAIRS.

- 236 **Structure.** The *Hair Follicle* is a depression of the skin.

It is composed:—1st, of an *External Layer*, corresponding to the dermis proper;—2d, of an *Internal Transparent Layer*, corresponding to the basement membrane of the skin;—3d, of the *External Root Sheath*, corresponding to the mucous layer;—4th, of the *Internal Root Sheath*, corresponding to the cuticle and composed of a layer corresponding to the granular layer of the skin, and of a layer corresponding to the transparent layer of the skin;—5th, at the bottom is the *Hair Papilla* supporting the hair bulb.

The *Hair Bulb* is formed of an agglomeration of soft, round, oval and elongated cells.

The *Body of the Hair* is composed of:—1st, the *Cuticle*;—2d, of the *Fibrous or Cortical layer*;—and 3d, of an *Internal or Medullary layer*.

GLANDS OF THE SKIN.

- 237 The glands of the skin are:—1st, the *Sebaceous Glands*, situated in the dermis proper and almost all opening into the hair follicles; they are racemose glands;—2d, the *Sweat Glands*, situated in the meshes of the deep surface of the dermis; they are convoluted tubular glands.

NAILS.

238 **Structure.** The nails are composed, from without inwards:—1st, of a *Horny Layer*, corresponding to the epidermis of the skin;—2d, of a *Mucous Layer*;—3d, of a *Papillary Layer* forming the matrix.

239 Peculiarities of the Skin.

It resembles very much the mucous membranes.

The fact that the superficial layer of the epidermis or the cuticle is composed of flat, dry, dead cells is noticeable.

Also that the deep layer or mucous layer is composed of round and oval soft and living cells.

The Pigmented Cells in the negro are peculiar.

The absence of all vessels and nerves in the above layers is noticeable.

The Papillæ are peculiar (like in the tongue only).

The termination of the fibrils of the nerves into the tactile corpuscles is peculiar.

Also the appearance of the capillaries, poplar-like, as in the tongue.

Peculiarities of the Hair.

They are peculiar to the skin.

The hair follicle is noticeable.

Also the hair papilla.

The structure of the hair bulb is peculiar.

The absence of all vessels and nerves is noticeable.

240 Peculiarities of the Sebaceous Glands.

They are peculiar to the skin.

Their opening into the hair follicles is peculiar.

The Ceruminous Glands are varieties of sebaceous glands.

The Meibomian Glands also.

Peculiarities of the Nails.

They are unique.

The fact that they correspond to the cuticle in other situations is noticeable.

Absence of intermediate capillaries is remarkable.

ORGANS OF LOCOMOTION.

CARTILAGES.

241 **Structure.** Cartilages are composed:

1st. Of an investing membrane called the *Perichondrium*.

2d. Of a *Matrix or Interstitial Substance* which is amorphous, homogeneous or granular.

3d. Of *Cartilage Lacunæ* lined by a capsule containing fluid and one or more nucleated cells.

- 242 **Varieties.** There are the following varieties of cartilage: the *true cartilage* (deprived of matrix), the *fibro-cartilage*, and the *fibro-elastic cartilage*.

BONES.

- 243 **Chemical Composition of Bones.** The *Earthy Elements* are phosphates and carbonates of lime, which form the two-thirds.

They are demonstrated by macerating a bone in a diluted acid.

The *Organic Elements* form one-third.

They are demonstrated by burning a bone.

- 244 **Structure of Bones.** Bones are composed:

1st. Of an envelope, the *Periosteum*, the outer layer of which is fibrous, but the inner is formed of cells and capillaries.

2d. Of a *Proper Tissue* composed of the *Haversian Canals*, which contain the blood vessels.

3d. Of the *Lacunæ* and *Canalicules* which convey the serum of the blood throughout the substance of the bone.

4th. Of the *Medulla* or *Marrow*, which is either *yellow* or *red*.

It is composed of alveoles containing fat cells, and in the red marrow peculiar cells called *medulla-cells* and the multinucleated cells or *giant-cells*.

RESUMÉ OF POINTS OF SPECIAL INTEREST CONCERNING THE VERTEBRÆ.

1. CERVICAL VERTEBRÆ.

- 245 The *body* presents two tubercles;—the *transverse processes* are grooved and present orifices for vertebral arteries;—the *spinal orifice* is large and triangular;—the *spinal process* is bifid.

- 246 **First Cervical or Atlas:** The *body* is narrow; it is replaced by two arches; the *spinal orifice* is very large; the front is filled by the odontoid process; the *articular surfaces* are very large;—the *spinous process* is nearly absent.

Second Cervical or Axis: is characterized by the odontoid process.

Seventh Cervical: is characterized by a prominent spinous process.

2. DORSAL VERTEBRÆ.

- 247 The *body* presents articular facets;—the *spinal orifice* is small and round;—the *spinous process* is large and oblique;

—the *transverse processes* present articular facets for the ribs.

248 **First Dorsal.** The *body* presents a full facet.

Ninth Dorsal. The *body* presents a demi-facet above.

Tenth Dorsal. The *body* presents only one facet which is entire.

Eleventh Dorsal. The *body* presents only one facet which is entire;—the *transverse processes* present no articular facets for ribs.

Twelfth Dorsal. Same; the *inferior articular surfaces* are convex and turned outwards.

3. LUMBAR VERTEBRÆ.

249 **Lumbar Vertebrae.** The *body* presents no tubercle, no facet;—the *spinal orifice* is small and triangular;—the *spinous process* is short and thick;—the *transverse processes* are long and present processes resembling rudimentary ribs;—the *upper articular process* presents a marked tubercle.

Fifth Lumbar. The *inferior articular facets* are wider apart;—the *transverse processes* are larger and thicker.

SACRUM.

250 The **Anterior Surface** presents,—on the *middle line*, transverse ridges;—and on the *sides* the anterior sacral foramina. The **Posterior Surface** presents,—on the *middle line*, the spinous processes;—and on the *sides*, the sacral grooves, posterior sacral orifices and transverse processes.

The **Base** presents,—on the *middle line*, the articular surface for the fifth lumbar, the orifice of the sacral canal—and on the *sides*, the round edge of the brim, and a flat surface above.

The **Lateral Surfaces** present—*above*, the articular surface, which is lined in front with cartilage, but behind is rough;—*below*, the surface presents a border giving attachment to the sacro-sciatic ligaments.

The **Apex** presents the orifice of the sacral canal, and the articular surface for the coccyx.

SPINE IN GENERAL.

251 **Direction.** The Spine presents a convexity in the cervical region, a concavity in the dorsal region, a second convexity in the lumbar region and a second concavity in the sacral.—Besides, it presents a left lateral concavity opposite the upper dorsal vertebrae for the lodgment of the aorta.

Shape. The spine has the shape of two pyramids opposed by their bases, the sacral and the vertebral.

Besides, the cervical vertebrae represent a pyramid whose

apex joins the apex of the pyramid formed by the dorsal vertebræ.

The **Anterior Surface** presents the bodies of the vertebræ. The **Lateral Surfaces** present the intervertebral foramina, the pedicles, the transverse processes, the articular processes.

The **Posterior Surface** presents the spinous processes and the laminæ.

The **Upper Extremity** articulates with the occipital.

The **Inferior Extremity** is formed by the coccyx;—it gives attachment to the anal sphincter.

The **Spinal Canal** is large and oval in the cervical region;—it is smaller and round in the dorsal region;—it enlarges again in the lumbar, where it is also oval.

BONES OF THE SKULL.

- 252 **Enumeration.** The Bones of the Cranium are:—on the *Median line and Single*, the Frontal, Ethmoid, Sphenoid, Occipital;—on the *Sides and Double*, the Parietal and Temporal.

FRONTAL.

- 253 **1st. The Vertical Portion or Frontal Proper.**

The **Anterior Surface** presents on the *median line*: the ridge or suture between the two halves of the bone,—the nasal eminence articulating with nasal bones,—the nasal notch and the nasal spine or process.

It presents on the *sides* the frontal eminence or protuberance,—the superciliary eminence or ridge corresponding to the frontal sinus,—the supra-orbital notch or foramen,—the internal angular or orbital process,—the external angular or orbital process.

The **Posterior Surface** presents on the *median line* the groove of origin of the superior longitudinal sinus,—the frontal crest giving attachment to cerebral falx,—the cæcal foramen.

It presents, on the *sides*, the frontal fossa, presenting eminences and depressions corresponding to the convolutions, and the Pacchionian depressions.

- 254 **2d. Horizontal Portion or Orbital Vaults.**

The **Inferior Surface** presents on the *median line* the ethmoidal notch articulating with ethmoid,—the nasal spine,—the openings of the frontal sinus.

It presents on the *sides* the orbital fossa or concavity of the vault,—the lachrymal fossa.

The **Upper Surface** presents on the *median line* the ethmoidal notch,—and on the *sides* the orbital vault or convexity of the vault, presenting eminences and depressions corresponding to the convolutions.

255 **3d. Lateral Portions.**

The **External Surface** forms part of the temporal fossa;—it is separated by the temporal ridge from the temporal portion of the bone.

The **Internal Surface** forms part of the anterior cerebral fossa.

The **Upper Border of the Frontal** is serrated, beveled and articulates with the parietal bones;—it forms the fronto-parietal suture.

The **Inferior Border** is not serrated,—it articulates with the sphenoid.

The **Upper Angle of the Frontal** articulates with the receding angle of the two parietal;—it forms the anterior fontanelle.

The **Outer Angle** (external angular or orbital process) articulates with the malar bone.

ETHMOID.

256 **Situation.** The Ethmoid is situated in the ethmoidal notch of the frontal bone in front of the sphenoid, protruding into and forming all the upper part of the nasal cavities.

257 **1. The Horizontal or Cribriform Plate** presents on the *median line* the cæcal foramen, the crista-galli, an eminence for the attachment of the cerebral falx.

It presents on the *sides* the olfactory groove for the olfactory nerve,—the foramina for the filaments of the olfactory nerve,—the posterior notch articulating with the sphenoid.

258 **2. The Perpendicular Plate** presents surfaces and borders.

The **Surfaces** form the upper part of the nasal septum.

The **Upper Border** is attached to the horizontal plate.

The **Lower Border** articulates with the triangular cartilage of the septum.

The **Anterior Border** articulates with the nasal spine (of the frontal).

The **Posterior Border** articulates with the rostrum of the sphenoid and the vomer.

259 **3. The Lateral Masses or the Ethmoid Cells** present also surfaces and borders.

The **Upper Surface** articulates with the ethmoidal notch of frontal.

The **Anterior Surface** articulates with the lachrymal bone and nasal process of superior maxilla.

The **Inferior Surface** articulates with the superior maxilla itself.

The **Posterior Surface** articulates with the sphenoid and palate bones.

The **External Surface** is called the *Os Planum*;—it is smooth, thin,—forms part of the orbit,—articulates above

with the frontal, in part with the lachrymal, below with the superior maxilla and palate bones, behind with the sphenoid.

The **Internal Surface** forms the upper part of the external wall of the nasal cavities;— it presents two processes, called the superior and middle turbinated processes, and in front a surface for the filaments of the olfactory nerves.

- 260 4. The **Ethmoid Cells** form two groups not communicating with each other, the anterior or frontal and the posterior or sphenoidal.

SPHENOID.

- 261 **Situation.** The sphenoid is situated at the base of the skull, between the occipital and the frontal.

It articulates with the other cranial bones.

It presents a Body, Two Large Wings, Two Small Wings, and Two Pterygoid Processes.

BODY OF SPHENOID.

- 262 The **Upper Surface** presents on the *Median line*: smooth surfaces giving passage to the olfactory nerve;— the optic grooves for the optic nerves;— the pituitary fossa;— the square surface for oblong medulla.

It presents on the *sides* the optic foramen,— the anterior clinoid processes,— the orifice or notch communicating with the cavernous sinus,— the posterior clinoid processes.

The **Anterior Surface** presents on the *median line*, the anterior sphenoidal spine;— it articulates with the ethmoid.

It presents on the *sides* the orifice leading into the sphenoidal sinus,— the sphenoidal turbinated bones, which are two thin curved plates of bone partially closing the orifice of the sphenoidal sinus.

The **Inferior Surface** presents on the *median line*, the rostrum or sphenoidal spine articulating with the vomer.

It presents on the *sides* the vaginal process which forms a groove articulating with the wing of the vomer;— the pterygo-palatine groove articulates with the palate bone and forms the pterygo-palatine canal.

The **Posterior Surface** articulates with the occipital;— it is often united with it.

The **Lateral Surfaces** present above the cavernous groove;— below they are blended with the great wing.

THE LESSER WINGS OR UPPER WINGS.

- 263 The **Upper Surface** is smooth and is in relation with the anterior lobe of the brain.

The **Under Surface** forms part of the roof of the orbit.

The **Anterior Border** articulates with frontal.

The **Posterior Border** is smooth, free,—and forms the upper boundary of the sphenoidal fissure.

The **Base** presents the anterior clinoid processes and the optic foramen.

The **Apex** terminates in a sharp point.

GREATER WINGS OR MIDDLE WINGS.

264 The **Upper Surface** presents the round foramen,—the oval foramen,—the Vesalian foramen,—the spinous foramen,—the spinous process,—and the fossa forming part of the middle cerebral fossa.

The **Inferior Surface** presents a surface forming the roof of the zygomatic fossa,—the oval foramen—and the spinous foramen.

The **External Surface** presents the pterygoid ridge which separates this surface from the inferior surface,—the surface forming part of the temporal fossa.

The **Internal or Anterior Surface** forms part of the outer wall of the orbit;—behind, it forms part of the sphenoidal fissure;—below, it forms part of the speno-palatine orifice and of the pterygo-maxillary fissure.

The **Anterior Border** articulates with the malar bone.

The **Superior Border** articulates with the frontal bone and parietal bone.

The **External Border** articulates with the squamous temporal bone.

The **Posterior Border** articulates with the petrous temporal bone.

The **Internal Border** is blended with the body.

PTERYGOID PROCESSES OR LOWER WINGS.

265 The **Anterior Surface** *above* forms the posterior boundary of the speno-maxillary fossa,—and presents a groove forming the pterygo-maxillary canal;—*below* it articulates with the palate bone.

The **Posterior Surface** presents the scaphoid fossa—and the pterygoid fossa, which is limited by the inner and outer pterygoid plates.

The **External Surface** forms part of the zygomatic fossa.

The **Internal Surface** forms the outer boundary of the posterior nares.

The **Base** is attached to the body of the greater wing;—it presents the Vidian canal—and the round foramen.

The **Apex** is notched;—it presents the *hamular process* connected with the inner plate,—it articulates with the palate.

OCCIPITAL.

266 **Situation.** The Occipital is situated at the posterior part of the skull.

The **External Surface** presents on the *median line* a smooth surface for the occipital-frontal muscle,—the external occipital protuberance,—the occipital crest,—the occipital foramen with the tubercles for the check ligaments,—the basilar process.

It presents *on the sides*—the superior curved line,—the inferior curved line,—the posterior condyloid fossa and foramen,—the jugular process,—the occipital condyle,—and the anterior condoloid fossa and foramen.

The **Internal Surface** presents on the *median line* a groove for the superior longitudinal sinus,—the internal occipital protuberance with the press of Herophilus,—the internal occipital crest with grooves for the occipital sinus,—the occipital foramen,—with anterior condyloid foramen,—the basilar groove, for oblong medulla.

It presents *on the sides* :—the cerebral fossa,—the groove of the lateral sinus,—the cerebellar fossa,—the jugular process,—the depression for the terminal groove of lateral sinus,—and the anterior condyloid foramen.

The **Upper Border** is *serrated*;—it articulates with the parietal bones and forms the lambdoid suture.

The **Inferior Border** *between the external angle and jugular process* articulates with the mastoid temporal bone;—*between the jugular process and the anterior angle* it articulates with the petrous bone— and forms the jugular foramen or posterior lacerated foramen.

The **Upper Angle** articulates with the parietal bones— and forms the posterior fontanelle.

The **External Angle** articulates with parietal bones— and the mastoid process.

The **Anterior Angle** articulates with the body of sphenoid.

PARIETAL BONES.

267 The **External Surface** presents the parietal foramen,—a smooth surface for the occipito-frontal muscle,—the temporal ridge,—the parietal eminence or protuberance— and the surface of temporal fossa.

The **Internal Surface** presents a groove for the superior longitudinal sinus,—the Pacchionian depressions,—the parietal fossa,—the grooves for middle meningeal artery, the main branch starting from the anterior inferior angle;—the groove for the terminal portion of lateral sinus.

The **Anterior Border** is *serrated*;—it articulates with the frontal, forming the coronal suture.

The **Upper Border** is serrated;—it articulates with its fellow—and forms the bi-parietal or sagittal suture.

The **Posterior Border** is serrated—and articulates with the occipital, forming the lambdoid suture.

The **Inferior Border** is beveled;—it articulates with the squamous temporal bone.

The **Inferior Anterior Angle** articulates with the frontal and sphenoid.

The **Superior Anterior Angle** articulates with the frontal—and forms the anterior fontanelle.

Superior Posterior Angle articulates with the occipital,—and forms the posterior fontanelle.

The **Inferior Posterior Angle** articulates with the mastoid temporal bone.

TEMPORAL BONES—SQUAMOUS PORTION.

- 268 The **External Surface** presents a surface forming the temporal fossa,—the posterior limit of the temporal ridge,—the *Zygomatic Process*.

The external surface of this process is subcutaneous;—it forms the external boundary of the temporal fossa.

The upper border gives attachment to the temporal fascia.

The lower border gives attachment to the masseter.

The apex articulates with the malar bone.

The base presents the exterior transverse root of the zygoma—the zygomatic tubercle for the attachment of the external lateral ligaments;—the articular eminence,—the glenoid fossa,—the posterior root, which is continuous with the posterior limit of the temporal ridge.

The **Internal Surface** presents eminences and depressions for the convolutions of the brain,—and grooves for the middle meningeal artery.

The **Upper Border** articulates with the parietal bone—and forms the squamous suture.

The **Anterior Border** articulates with the greater wing of the sphenoid.

The **Inferior Border** is blended with the petrous bone.

MASTOID PORTION.

- 269 The **External Surface** is rough—and presents the mastoid foramen.

The **Internal Surface** presents the terminal groove of the lateral sinus.

The **Posterior Border** articulates with the occipital.

The **Anterior Border** is blended with the squamous and petrous bones.

The **Base** articulates with the parietal.

The **Apex** presents the mastoid process,—the digastric groove—and the groove for the occipital artery.

PETROUS PORTION.

- 270 The **Anterior Surface** presents from within outwards: the fossa for the Gasserian ganglion,—the groove for the small petrosal nerve,—the hiatus of Fallopius for the large petrosal nerve,—the projection of the superior semi-circular canal,—and the thin roof of the tympanum.
- The **Posterior Surface** presents from within outwards—the internal auditory meatus,—the aqueduct of the vestibule.
- The **Inferior Surface** presents a rough surface for muscular attachments,—the orifice of carotid canal,—the jugular fossa,—the jugular surface,—the stylo-mastoid foramen,—the styloid process,—the vaginal process,—the posterior glenoid fossa,—and the auditory process.
- The **Anterior Border** presents a free portion which articulates with the spinous process of the sphenoid;—in the receding angle we find the orifices of the Eustachian tube and of the canal for the tensor muscle of the mallet;—it is partly blended with the squamous portion.
- The **Upper Border** presents the superior petrosal sinus.
- The **Posterior Border** presents a groove for the inferior petrosal sinus,—the notch for the jugular foramen.
- The **Base** is blended with the squamous and mastoid bones;—it presents the external auditory meatus.
- The **Apex** articulates with the sphenoid and the occipital;—it presents the internal orifice of the carotidian canal.

BONES OF THE FACE.

- 271 The **Upper Jaw** comprises thirteen bones, which are: on the *Middle Line*, the Vomer;—on the *Sides*, the Nasal, Lachrymal, Inferior Turbinated, Palate, Superior Maxillar and Malar Bones.
- The **Lower Jaw** contains only the Inferior Maxillary Bone.

VOMER.

- 272 **Situation.** The Vomer is situated at the back part of the nasal septum.
- The **Surfaces** are alternately concave and convex.
- The **Upper Border** presents a groove articulating with the rostrum of the sphenoid;—it presents also laminae or wings articulating with the vaginal process of the sphenoid.
- The **Lower Border** articulates with the palate processes of the superior maxillary bone.
- The **Posterior Border** is free and concave;—it separates the posterior nares.
- The **Anterior Border** articulates with the ethmoid,—and also with the septal cartilage of the nose.

SUPERIOR MAXILLARY BONE.

- 273 The **Internal Surface** presents the nasal process, the internal surface of which presents two ridges for articulation, with the middle and inferior turbinated bones, and between them the middle meatus;—the lachrymal groove and sac,—the nasal canal,—the inferior meatus,—the opening of the antrum of Highmore,—an articular surface,—the maxillary fissure for the process of the palate bone.

The *Palate Process* presents an *Upper Surface* forming part of the floor of the nasal cavity,—an *Under Surface* forming the roof of the mouth and hard palate;—an *Outer Border* blended with the bone,—an *Inner Border* articulating with its fellow,—a *Base* traversed by the anterior palatine (incisive) canal,—an *Aper* or *Posterior Border* articulating with the palate bone.

The **External Surface** presents the nasal process (external surface)—the anterior margin of the orbit,—the infra-orbital foramen,—the canine fossa,—the incisive or myrtiform fossa,—the ridge of the alveole of the canine tooth.

The **Upper Surface** forms the floor of the orbit.

It presents the infra-orbital groove,—a depression for the insertion of the inferior oblique muscle,—the malar process articulating with the malar bone.

The **Posterior Surface** presents the posterior margin of the orbit or anterior boundary of spheno-maxillary fissure,—the orifices of the posterior dental canals,—a concave surface corresponding to the malar process and to the zygomatic fossa.

The **Anterior Border** articulates with the nasal bone.

It presents a notch giving attachment to the lateral cartilage of the nose,—the anterior spinous process of superior maxilla.

The **Superior Border** presents the apex of the nasal process articulating with frontal bone,—the lachrymal groove, where it articulates with the lachrymal bone;—further back it articulates with the ethmoid and palate bones.

The **Inferior Border** is called the *alveolar process*;—it presents the sockets for the teeth.

The **Posterior Border** is called the *tuberosity of the superior maxilla*;—it forms the pterygo-maxillary fissure,—articulates with the palate bone,—and forms the posterior palatine canal

NASAL BONES.

- 274 **Situation.** The Nasal Bones form the upper part of bridge of the nose.

The **Outer Surface** gives attachment to muscles.

The **Inner Surface** forms part of the nasal cavities,—and presents a groove for a branch of the nasal nerve.

The **Anterior Border** articulates with its fellow;—it presents a groove articulating with the nasal spine of the frontal and with the ethmoid.

The **Posterior Border** articulates with the nasal process of the superior maxilla.

The **Apex** articulates with the frontal bone.

The **Base** articulates with the lateral nasal cartilage—and presents a notch for the nasal nerve.

LACHRYMAL BONES.

- 275 **Situation.** The Lachrymal Bones are situated on the front part of the inner wall of the orbit.

The **External Surface** presents a groove for the lachrymal canal,—a ridge for the attachment of the tensor muscle of the tarsal cartilages,—and a surface forming part of the orbit.

The **Internal Surface** forms a part of the nasal cavity.

The **Anterior Border** articulates with the nasal process of the superior maxilla.

The **Posterior Border** articulates with the ethmoid.

The **Apex** articulates with the internal angular process of the frontal.

The **Base** presents the lachrymal process articulating with the inferior turbinated bone,—the lower edge of the vertical crest;—it articulates with superior maxilla.

INFERIOR TURBINATED BONES.

- 276 **Situation.** The Inferior Turbinated Bones are situated on the outer wall of the nasal fossa, immediately below the orifice of the antrum.

The **Internal Surface** is convex,—is ragged and perforated;—it forms the inferior meatus.

The **Upper Border** articulates with the superior maxilla.—

Behind, it articulates with the palate bone.

The **Lower Border** is free and rounded.

The **Anterior Extremity** is pointed.

The **Posterior Extremity** is also pointed.

PALATE BONES.

Situation. The Palate Bones are situated back of the nasal fossæ, resting on the posterior border of the superior maxilla.

They present an horizontal and a vertical plate.

HORIZONTAL PLATE.

- 277 The **Upper Surface** forms the back part of the floor of the nasal cavities.

The **Under Surface** forms the back part of the roof of the mouth or hard palate.

The **Anterior Border** articulates with the palate process of the superior maxilla.

The **Internal Border** articulates with its fellow and the vomer.

The **Posterior Border** is free — and gives attachment to the soft palate.

The **External Border** is blended with the vertical plate.

VERTICAL PLATE.

- 278 The **Internal Surface** presents the superior meatus — the middle turbinated crest, — the middle meatus, — the inferior turbinated crest, — the inferior meatus.

The **External Surface** forms a part of the pterygo-maxillary fossa; — it articulates with the superior maxilla.

The **Anterior Border** forms part of the edge of the antrum.

The **Inferior Border** is blended with the horizontal plate.

The **Posterior Border** presents a groove articulating with the pterygoid process of the sphenoid; — the pterygoid process or tuberosity of the palate articulating with the notch of the apex of the pterygoid process of the sphenoid.

The **Upper Border** presents — the *Orbital Process*, presenting three articular surfaces: the anterior or maxillary, the internal or ethmoidal, the posterior or sphenoidal and two facets for connection, an upper or orbital and an external or zygomatic.

It presents also the *Spheno-palatine Notch* and the *Sphenoidal Process*.

The *upper surface* of the sphenoidal process articulates with the sphenoidal turbinated bone; — the *inner surface* of the nasal forms part of the wall of the nasal cavity; — the *outer surface* forms part of the spheno-maxillary fossa and articulates with the pterygoid process of sphenoid; — the *anterior border* forms part of spheno-palatine foramen — and the *posterior border* articulates with the pterygoid process.

MALAR BONES.

- 279 **Situation.** The Malar Bones form the prominence of the cheeks.

The **External Surface** presents the malar foramina.

The **Internal Surface** forms the outer wall of the temporal fossa.

The **Anterior Surface** forms part of the orbit.

The **Superior Border** forms part of the margin of the orbit.

The **Anterior Border** articulates with the malar process of the superior maxilla.

The **Inferior Border** forms part of the zygomatic arch.

The **Posterior Border** is smooth above—and limits the temporal fossa;—it articulates below with the zygomatic process.

The **Internal Border** articulates with the frontal above and the sphenoid below.

INFERIOR MAXILLARY BONE.

Situation. The Inferior Maxillary forms the lower jaw.

HORIZONTAL PORTION OR BODY.

280 The **External Surface** presents on the *middle line* the symphysis—and the mental process.

It presents on the *sides* the incisive fossa,—the mental foramen (below the root of the second bicuspid),—the external oblique line,—a subcutaneous surface,—the groove for the facial artery.

The **Internal Surface** presents on the *middle line* the symphysis and the genial tubercles,—two upper and two lower.

It presents on *either side*—the fossa for the sublingual gland,—the digastric fossa,—the internal oblique line or mylohyoid ridge,—the submaxillary fossa.

The **Superior Border** presents the alveoles or sockets for the teeth.

The **Inferior Border or Base** is smooth,—it is subcutaneous.

PERPENDICULAR PORTIONS OR RAMI.

281 The **External Surface** gives attachment to the masseter muscle.

The **Internal Surface** presents the posterior orifice of the interior dental canal,—the spinous process for internal lateral ligament,—mylohyoid groove,—rough surface for internal pterygoid.

The **Anterior Border** is partly blended with the horizontal portion.

The **Upper Border** presents the coronoid process for the temporal muscle,—the sigmoid notch,—the condyloid process,—presenting on the neck a tubercle for the external ligament,—the pterygoid fossa.

The **Posterior Border** is smooth,—it joins the inferior border and forms the angle of the jaw.

The **Inferior Border** is continuous with the base.

RESUMÉ OF THE SITUATION OF THE BONES OF THE HEAD AND OF THEIR VARIOUS PARTS.

BONES OF THE SKULL.

282 **On the Middle Line**, from before backwards.

The frontal,—the plate of the ethmoid,—the body of the sphenoid,—the basilar process of the occipital bone,—also the vertical portion of the occipital.

On the Sides :

The lateral portion of the frontal or frontal eminences,—the horizontal portion,—the vertical portion,—the lesser wing of the sphenoid,—the lateral mass of the ethmoid, the greater wing,—the petrous bone,—the parietal,—the squamous portion,—the mastoid,—the lateral part of the horizontal and the vertical portion of the occipital.

BONES OF THE FACE.

283 The **Upper Jaw** is composed of thirteen bones.

They form four rows.

The **First Row** is formed by the Vomer alone on the middle line.

The **Second Row** comprises from before backwards, the the nasal, lachrymal, the inferior turbinated and the palate.

The **Third Row** is formed by one bone alone, the superior maxilla.

The **Fourth Row** is also formed by one alone, the malar.

N. B.—All the bones are situated to the inside of the superior maxilla except the malar.

The **Superior Maxilla** is the bone of the face, like the sphenoid is the bone of the skull.

It articulates with all the bones of the face and with a number of bones of the skull.

The **Ethmoid** protrudes into the nasal cavities.

The **Inferior Turbinated Bones** rest on the inner surface of the superior maxilla.

The **Palate Bones** rest on the posterior surface of the superior maxilla.

The **Lower Jaw** is formed by one bone only, the Lower Maxilla.

SUTURES OF THE SKULL.

284 The **Sutures of the Upper Region or Vertex** are :

On the *middle line*,—the interfrontal,—the anterior fontanelle,—interparietal or sagittal,—the posterior fontanelle.

On the *sides*,—the fronto-parietal or coronal,—parieto-occipital or lambdoid.

The **Sutures of the Lateral Surfaces** are the fronto-

malar,—malo-sphenoidal,—spheno-frontal,—spheno-parietal,—spheno-squamous,—parieto-mastoid,—masto-occipital.

The **Sutures of the Base or Basilar Sutures** are, on the *middle line*, the occipito-sphenoidal.

On the *sides*, the spheno-petrosal,—spheno-squamous,—petro-squamous,—occipito-petrosal,—occipito-mastoid.

CRANIO-FACIAL SUTURES.

- 285 Have received no special names except the **Transverse Suture**, which is formed by the junction of the frontal with the facial bones;—it extends from the *external angle* or orbital process on one side to the opposite side;—it connects the frontal with the nasal, lachrymal, superior maxilla, ethmoid, sphenoid and malar bones;—it connects the sphenoid with the malar bones;—it connects the malar bone to the zygomatic process of temporal bone.

FACIAL SUTURES.

Have no special names.

EXTERIOR OF SKULL.

- 286 **Upper Region or Vertex.** It is bounded,—in *front* by the nasal eminence and superciliary ridges;—*laterally* by the temporal ridges;—*behind* by the external occipital protuberance.
- It presents on the *middle line*—the nasal eminence,—the interparietal suture or sagittal suture.
- It presents on the *sides*—the superciliary ridges,—frontal eminences,—fronto-parietal or coronal sutures—the parietal eminences—and the parieto-occipital or lambdoid sutures.
- 287 **Lateral Region of Skull.** It is bounded—*above* by the curved line of the temporal bone;—*in front* by a line extending from the external angular process of the frontal to the angle of the jaw;—*behind* by a line from the extremity of the superior curved line to the angle of the jaw.
- 288 1st. **Mastoid Region:** It is bounded—*in front* by the anterior root of the zygoma,—*above* by a line drawn from the posterior root of the zygoma to the end of the masto-parietal suture;—and below by the masto-occipital suture.
- It presents:*—A part of the squamous bone,—the mastoid process,—the mastoid foramen,—the articular eminence, the glenoid fossa,—the glenoid fissure,—and the external auditory meatus.
- 289 2d. **Temporal Fossa:** It is bounded—*in front, above and behind* by the temporal ridge,—*externally* by the zygomatic arch,—*internally* by the pterygoid ridge.
- It is formed* by the frontal, malar, parietal, temporal and sphenoid bones.

Its *sutures* are the transverse facial, coronal, *spheno-parietal*, squamo-parietal, squamo-sphenoidal.

- 290 3d. **Zygomatic Fossa**: It is bounded—in *front* by the tuberosity of the superior maxilla,—*behind* by posterior border of the pterygoid process,—*above* by the pterygoid ridge,—*below* by the alveolar border of the superior maxilla,—*internally* by the external plate of the pterygoid process,—*externally* by the zygomatic arch and ramus of the jaw.

It presents the spheno-maxillary fissure,—and the pterygo-maxillary fissure.

- 291 4th. **Maxillary Fossa (or Pterygo-Maxillary Fossa)**: It is bounded—in *front* by the superior maxilla,—*behind* by the pterygoid process,—*above* by the body of the sphenoid,—*internally* by the vertical plate of the palate bone.

It presents *three fissures*, the sphenoidal, spheno-maxillary and pterygo-maxillary;—*five orifices*: one internal, the spheno-palatine; three posterior, the round, the vidian, and the pterygo-palatine; one inferior, the posterior palatine canal or maxillo-palatine.

It communicates with *four cavities*, the orbital, nasal, cranial and zygomatic.

INFERIOR REGION OR EXTERIOR OF THE BASE OF SKULL.

- 292 It is bounded—in *front* by the incisor teeth of the upper jaw;—*laterally* by the alveolar arch, lower border of malar, a line from the zygoma to the mastoid process and extremity of the superior curved line;—*behind* by the superior curved line of the occipital bone.

It presents several regions.

- 293 1st. **Palato-Pterygoid Region**: It presents on the *middle line*,—the anterior palatine canal, for vessels and nerves of the same name,—the articulation of the palate processes of the superior maxilla,—the articulation of the horizontal plates of the palate bones,—the posterior border of the vomer.

It presents *on the sides*,—the alveolar process,—the inferior surface of the palate processes of the superior maxilla,—the inferior surface of the horizontal plate of the palate bone,—the posterior nares,—the hamular process for the reflection of the tensor muscle of the palate,—and inner lamina of pterygoid process,—the pterygoid fossa, for insertion of the internal pterygoid muscle,—the outer lamina of the pterygoid process for insertion of external pterygoid muscle,—the scaphoid fossa for insertion of the tensor muscle of the palate,—the pterygoid or vidian canal.

- 294 2d. **The Occipital Region** presents on the *middle line*—the spheno-occipital suture,—the basilar process,—the occipital foramen for oblong medulla and vertebral arteries,—the

external occipital crest for the nuchal ligament,—the external occipital protuberance.

It presents *on the sides* — the anterior condyloid fossa and foramen for the hypoglossal nerve,—the occipital condyle articulating with the atlas,—the posterior condyloid fossa and foramen for a small vein,—the under surface of occipital for muscular attachment,—the inferior curved line for same,—and the superior curved line for same.

- 295 3d. **The Sphenoidal Region** presents — the under surface of the greater wing forming — the roof of the zygomatic fossa — the oval foramen for inferior maxillary nerve; — the spinous foramen for middle meningeal artery, — the spinous process of sphenoid.

- 296 4th. **The Petrous Region** presents — the petro-sphenoidal articulation — and middle lacerated foramen (formed by the articulation of apex of petrous bone with the body of sphenoid and — by articulation of anterior border of petrous bone with posterior border of greater wings), — the canal for the Eustachian tube, — a rough surface for muscular attachment, — the inferior orifice of carotid canal, — the vaginal process, — the posterior glenoid cavity, — the auricular process, — the external auditory meatus, — the petro-occipital foramen or posterior lacerated foramen (with jugular foramen for jugular vein, glosso-pharyngeal, pneumo-gastric and spinal accessory nerves), — the styloid process for attachment of stylian muscles and ligaments — and the stylo-mastoid foramen for facial nerve.

- 297 5th. **The Squamous Region** presents — the spheno-squamous suture, — the anterior root of zygoma with articular eminence, — the glenoid fossa which articulates with the condyle of the inferior maxilla, — the glenoid fissure which lodges the laxator muscle of tympanum, cord of the tympanum, and slender process of the malleus.

6th. **The Mastoid Region** presents — the occipito-mastoid suture, — the mastoid foramen for a vein to lateral sinus, — a groove for the occipital artery, — the digastric groove for digastric muscle, — the mastoid process for sterno-mastoid muscle.

ANTERIOR REGION OF SKULL: FACE—ORBITS.

- 298 The **Orbits** are formed by seven bones: frontal, ethmoid, sphenoid, superior maxillary, lachrymal, palate, malar.

The **Roof** is formed by the frontal and lesser wing of sphenoid. — It presents — a depression for the pulley of the superior oblique muscle — and one for lachrymal gland.

The **Floor** is formed by the superior maxillary, malar and palate bones. — It presents a depression for insertion of inferior oblique muscle — and the infra-orbital groove.

The **Inner Wall** is formed by the lachrymal, ethmoid,

sphenoid and palate bones.—It presents the lachrymal groove and the lachrymal crest.

The **Outer Wall** is formed by the malar and sphenoid bones.—It presents the orifices of the two malar canals.

The **Superior Internal Angle** presents—the fronto-lachrymal suture,—the fronto-ethmoidal suture,—the ethmoidal foramina.

The **Superior External Angle** presents—the fronto-malar—and fronto-sphenoidal sutures,—and the sphenoidal fissure or anterior lacerated foramen.

The **Inferior Internal Angle** presents—the sutures of the lachrymal and superior maxillary bones—and of the ethmoid and palate bones.

The **Inferior External Angle** presents the sphenomaxillary fissure.

The **Circumference or Base of Orbit** is bounded—*internally*, by the nasal process of the superior maxillary bone and the internal angular process of the frontal with the lachrymal canal;—*above*, by the supra-orbital arch with foramen;—*externally*, by the external angular processes of frontal and malar bones;—and *below*, by the malar bone and superior maxilla.

The **Apex** presents the optic foramen, formed by the small wing of the sphenoid.

299 2d. **Nasal Fossæ. Boundaries:** The Nasal Fossæ are formed by fourteen bones:—three of the cranium, frontal, ethmoid and sphenoid,—and all the bones of the face, except the malar and inferior maxillary.

The **Roof** is formed by the nasal bones, nasal spine of frontal, cribriform plate of ethmoid and sphenoidal turbinated bones.

The **Floor** is formed by the palate process of the superior maxillary,—and the horizontal plates of the palate bones.

It presents—the orifice of anterior palatine canal.

The **Inner Wall** is formed by the ethmoid, vomer and septal cartilage.

The **Outer Wall** is formed by the nasal process, lachrymal bone, ethmoid, superior maxilla and vertical plate of palate bone.

It presents—the surface for the filaments of the olfactory nerve,—the superior turbinated bone,—the superior meatus with ethmoid and sphenoid openings,—the middle meatus with openings of the antrum,—the inferior turbinated bone, the inferior meatus and orifice of nasal canal.

The **Posterior Nares** are bounded—*above* by the sphenoid,—*internally* by the vomer,—*externally* by vertical plate of palate bone,—*below* by the horizontal plate.

The **Anterior Nares** are bounded by the superior maxillary and nasal bones.

INTERIOR OF SKULL AS A WHOLE.

- 300 **Divisions:** Upper Region or Roof, and Lower Region or Base.

Boundaries: Circular line passing one inch above nasal eminence of frontal—and behind one inch above external occipital protuberance.

- 301 The **Upper Region or Roof** presents, on the *middle line*—the frontal crest,—the inter-frontal and sagittal sutures,—the groove for the superior longitudinal sinus,—the Pachionian depressions.

On the *sides*:—the parietal fossa,—the arterial grooves,—the depressions for convolutions,—the coronal or fronto-parietal suture,—the lambdoid or parieto-occipital suture. The **Base** presents the anterior, middle, and posterior cerebellar fossæ.

- 302 **Anterior or Frontal Cerebral Fossa:**

It is formed by the cribriform plate of the ethmoid, the frontal, and small wings of sphenoid.

It presents on the *middle line*—the frontal crest,—the blind foramen, the surface of the grey root of the optic nerve.

It presents on the *sides*—the olfactory grooves with the foramina of the cribriform plate, eminences and depressions for convolutions.

- 303 **Middle or Sphenoidal Cerebral Fossa:**

It is formed by the body of the sphenoidal greater wings,—squamous portion of temporal bone,—and anterior surface of petrous portion.

It presents on the *middle line* the olivary process—and the pituitary fossa.

It presents on the *sides*—the optic foramina—the anterior and posterior clinoid processes giving attachment to the tentorium,—the groove for cavernous sinus,—the sphenoidal fissure giving passage to the ophthalmic vein, the third, the fourth, the first branch of the fifth, and the sixth nerves;—the round foramen for superior maxillary nerve,—the spinous foramen for middle meningeal artery,—the oval foramen for inferior maxillary nerve,—the middle lacerated foramen for arterioles and the petrosal nerves;—the internal orifice of the carotidian canal,—the depression for the Casserian ganglion,—the groove for small petrosal nerve,—the projection of superior semi-circular canal,—the roof of tympanum,—the groove for superior petrosal sinus,—the eminences and depressions for convolutions—and grooves for arteries.

- 304 The **Posterior or Occipital or Cerebellar Fossa:**

It is formed by the occipital bone,—posterior surface of petrous bone—and a small portion of the parietal.

It presents on the *middle line*—the basilar groove for the

oblong medulla,—the occipital foramen with the anterior condyloid foramen,—the occipital crest for cerebellar falx,—the internal occipital protuberance for cerebral falx,—the depression for the press of Herophilus.

On the sides—the internal auditory meatus for the facial and the auditory nerves,—the depressions for the convolutions, the posterior lacerated foramen or jugular foramen or occipito-petrosal suture,—the termination of lateral sinuses,—the masto-occipital surface,—the cerebellar fossa,—the beginning of lateral sinuses.

FORAMENS OF THE BASE OF THE INTERIOR OF THE SKULL AND ORGANS SITUATED THEREIN.

305 **Anterior or Frontal Cerebral Fossa.**

On the Middle Line—Blind foramen, so-called, for venule anastomosing with the superior longitudinal sinus.

On the Sides—Cribriform plate of the ethmoid, giving passage to the filaments of the olfactory nerves.

Middle of the Sphenoidal Cerebral Fossa.

On the Middle Line—Pituitary fossa.

On the Sides—Optic foramen for optic nerve and ophthalmic artery.

Sphenoidal Fissure (or Anterior Lacerated foramen), giving passage to the ophthalmic vein, the third, the fourth, the first branch of the fifth and the sixth cranial nerves.

Cavernous sinus,—giving passage to the internal carotid artery and the nerves just mentioned.

Round foramen, for the fifth Superior Maxillary nerve.

Spinous foramen, for the Middle Meningeal artery.

Oval foramen, for the Inferior Maxillary nerve.

Middle Lacerated Foramen (spheno-petrosal suture), giving passage to arterioles and to petrosal nerves.

Internal Orifice of Carotidean Canal for Internal Carotid Artery.

Groove for Superior Petrosal Sinus.

Posterior or Occipital or Cerebellar Fossa.

On the Middle Line—Occipital foramen, giving passage to the oblong medulla—the spinal accessory—the vertebral arteries.

On the Sides—Anterior Condyloid foramen for the hypoglossal nerve.

Internal Auditory Canal for the auditory, the facial and the nerve of Wrisberg.

Groove for Inferior Petrosal Sinus.

Posterior or Lacerated Foramen or Jugular Foramen (*i. e.*, Occipito-petrosal suture).

Jugular vein—the glosso-pharyngeal—pneumo-gastric—spinal accessory.

Mastoid Foramen for mastoid vein.

Lateral Sinuses, with Press of Herophilus.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE RIBS.

- 306 **Number:** There are Twelve Ribs on each side.
Division: There are seven true or vertebro-costal ribs, three false or vertebro-chondral ribs, and two floating ribs.
Direction: The ribs are twisted.
The **Head** presents two facets for articulation with the vertebrae.
The **Neck** presents on its upper border a crest for the costo-transverse ligament.
The **Tuberosity** presents a facet for articulation with the transverse process of a vertebra.
The **Angle of the Rib** is a marked ridge.
The **Inferior Border** of the body is grooved for the intercostal vessels and nerves.
The **Anterior Extremity** articulates with the costal cartilage;—this extremity is lower than the posterior extremity, corresponding horizontally behind to the head of the second rib above it.
- 307 **First Rib:** The head presents a single facet,—it presents the scalene tubercle,—a groove for the subclavian artery—and also one for the vein;—there is no angle or twist.
Second Rib: It presents a roughness for the posterior scalene and the great serrate muscles.
Tenth Rib: It presents a single facet on the head.
Eleventh Rib: It presents a single facet on the head;—it has no tuberosity;—the anterior extremity is pointed.
Twelfth Rib: It presents a single facet on the head;—it has no neck,—no tuberosity,—no groove;—it has a pointed extremity.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE STERNUM.

- 308 **Divisions.** The Sternum is divided into the *handle* or *first piece*, the *blade* or *second piece*;—the articulation of the two pieces persists sometimes late in life.—The *ensiform cartilage* is the point or third piece.
It presents articular facets for the costal cartilages and for the clavicle.
The *Posterior Surface* is in relation with the innominate vessels, pericardium and heart.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE CLAVICLE.

- 309 1st, a facet to articulate with the sternum;—2d, a tubercle for the attachment of the sterno-mastoid muscle and interclavicular ligament;—3d, a roughness for the costo-clavicular

lar ligament;—4th, a roughness of the subclavian muscle;—5th, convexity in front for attachment of great pectoral muscle—and also a concavity for the origin of the deltoid;—6th, concavity behind for attachment of sterno-mastoid;—7th, also convexity for the attachment of the trapezius;—8th, a facet for articulation with the acromion;—9th, a roughness of the costo-clavicular ligaments.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE SCAPULA.

- 310 The Scapula presents: 1st, the subscapular fossa;—2d, the supra-spinal fossa;—3d, the spine of the scapula—and acromion;—4th, the infra-spinous fossa;—5th, the coracoid process—for coraco-brachial, small pectoral and short head of the biceps;—6th, the origin of the long head of the biceps;—7th, the glenoid cavity;—8th, a roughness for the origin of long head of the triceps;—9th, an axillary border;—10th, a spinal border;—11th, a superior or coracoid border.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE HUMERUS.

- 311 They are:—1st, the head, which articulates with the glenoid cavity;—2d, the anatomical neck for the insertion of the capsular ligament;—3d, the lesser tuberosity for the insertion of the subscapular;—4th, the greater tuberosity with three facets for the insertion of the supra-spinous, infra-spinous, and small round;—5th, the bicipital groove for the long head of biceps, the anterior ridge for great pectoral;—6th, the surgical neck;—7th, the roughness for the deltoid;—8th, the musculo-spiral groove for the profunda artery and the musculo-spiral nerve;—9th, an outer border;—10th, an inner border;—11th, the olecranon fossa;—12th, the coronoid fossa;—13th, the internal condyle;—14th, the trochlea for the ulna;—15th, the groove for the edge of the head of the radius;—16th, the small head of the humerus for the head of the radius;—17th, the external condyle.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE ULNA.

- 312 They are:—1st, the olecranon process;—2d, the coronoid process;—3d, the greater sigmoid notch or cavity articulating with the humerus;—4th, the lesser sigmoid notch articulating with the radius;—5th, the roughness for the anterior brachial muscle;—6th, the outer border for the insertion of the interosseous ligament;—7th, the neck of

the ulna;—8th, the head of the ulna articulating below with the triangular fibro-cartilage, cuneiform bone and *on the side* with the radius;—9th the styloid process for internal lateral ligament;—10th, the groove for the insertion of the triangular ligament.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE RADIUS.

- 313 They are:—1st, the head articulating above with the small head of the humerus—and laterally with the lesser sigmoid notch of the ulna;—2d, the neck of the radius;—3d, the bicipital tubercle for the tendon of the biceps;—4th, the oblique line;—5th, the roughness for the round pronator;—6th, the inner border for the interosseous ligament;—7th, the supinator tubercle;—8th, the lower extremity articulating with the semilunar and scaphoid bones;—9th, the articular facet for the head of the ulna;—10th, the styloid process for the external lateral ligament;—11th, the grooves for the tendons.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE CARPUS.

- 314 The Carpus is composed of two rows of bones.

The *First Row* comprises—the *scaphoid*, resembling a boat and articulating with the radius;—the *semilunar*, resembling a crescent and articulating also with the radius;—the *cuneiform* or *pyramidal*, resembling a wedge and articulating with the fibro-cartilage and ulna;—the *pisiform*, resembling a pea, articulating with the cuneiform and giving attachment to the ulnar carpal flexor.

The *Second Row* comprises—the *trapezium*, articulating with the metacarpal bone of the thumb;—the *trapezoid*, smaller than the trapezium;—the *os magnum*, projecting upwards between the scaphoid and the semilunar;—the *unciform* bone, having a hook-like process for the attachment of the annular ligament.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE METACARPUS.

- 315 They are:—1st, facets for articulation with the carpal bones;—2d, lateral facets for articulation with one another;—3d, an anterior border for tendinous insertions;—4th, a head articulating with the first phalanx;—5th, lateral tubercles for the insertion of the lateral ligaments.

The *first metacarpal bone* or *metacarpal bone of the thumb* has no lateral facets and does not articulate with the others.

The *last metacarpal bone* presents no inner lateral facet.

RESUMÉ OF POINTS OF SPECIAL INTEREST
CONCERNING THE FIRST PHALANGES.

- 316 They are:—1st, a cavity articulating with the head of the metacarpal bones;—2d, a rough surface for the insertion of the sheath of the flexor tendons;—3d, the lower extremity presents the shape of a small pulley or trochlea, *i. e.*, two small eminences or heads separated by a groove;— it articulates with the second phalanx.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST
CONCERNING THE SECOND PHALANGES.

The *Upper Extremity* presents two small cavities separated by a ridge and articulates with the first phalanx;—rough borders for the insertion of the tendons of the superficial flexor.

The *Lower Extremity* presents a pulley.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST
CONCERNING THE THIRD PHALANGES.

The *Upper Extremity* presents two small cavities separated by a ridge.

The *Lower Extremity* has the shape of a horseshoe — and is rough for the insertion of the deep flexor.

The *Thumb* has no second phalanx.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST
CONCERNING THE INNOMINATE BONE.

- 317 **Divisions.** It comprises three portions, the Ilium, Pubis and Ischium.

The **Outer Surface** presents the superior curved line;— a rough surface for the great gluteal;— the middle curved line;— a rough surface for the middle gluteal;— the inferior curved line;— a rough surface for the small gluteal;— a groove for the reflected tendon of straight femoral muscle;— the acetabulum for the reception of the head of the femur;— the back cavity of the acetabulum not lined with cartilage and lodging the round ligament;— the acetabular or cotyloid notch;— the obturator foramen;— the obturator canal;— a groove for the tendon of the internal obturator;— the tuberosity of the ischium.

The **Inner Surface** presents — a rough surface for ligaments, — the auricular facet articulating with the sacrum;— the internal iliac fossa, — the brim of the pelvis, — a square surface corresponding to the acetabulum;— the obturator canal and the obturator foramen.

The **Upper Border or Iliac Crest** gives attachment to the oblique and transverse muscles.

The **Anterior Border** presents the anterior superior spinous process for the sartorius and Poupart's ligament;—a notch;—the anterior inferior spinous process for the straight femoral muscle;—a notch;—the pectineal eminence;—the horizontal branch of the pubis;—the iliopectineal line;—the spine of the pubis;—the crest of the pubis;—the angle of the pubis.

The **Internal Border** presents the descending branch of the ischium for the origin of the cavernous bodies and the great adductor.

The **Posterior Border** presents—the tuberosity of the ischium,—the lesser sacro-sciatic notch;—the spine of the ischium,—the greater sacro-sciatic notch;—the posterior inferior spinous process;—the posterior superior spinous process.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE PELVIS IN GENERAL.

- 318 The **Upper Strait or Inlet** is *limited*—behind by the sacrum,—laterally by the pelvic brim of the innominate bone—and in front by the pubis.

The **Diameters** are the *antero-posterior*, from sacro-vertebral angle to pubic symphysis,—the *transverse* or bi-iliac;—the *oblique*, extending from pectineal eminence to opposite sacro-iliac symphysis.

The **Upper Plane** is the surface included by those limits.

The **Axis of the Upper Strait** is the line passing perpendicularly through the centre of the upper strait;—it is directed backwards and downwards;—the upper extremity of the line corresponds to the umbilicus,—the lower extremity to the lower part of the concavity of the sacrum.

The **Lower Strait or Outlet** is limited—*behind* by the sacrum and coccyx;—*laterally* by the great sacro-sciatic ligament;—*anteriorly* by the arch of the pubis and the ischium.

The **Diameters** are *antero-posterior* or coccy-pubic, *transverse* or bi-ischiatic.

The **Lower Plane** is the surface included by those limits.

The **Axis of the Lower Strait** is the line passing perpendicularly through the centre of the lower plane;—it is directed backwards and upwards;—it corresponds to the axis of the vagina;—its upper extremity corresponds to the upper part of the sacrum.

RESUMÉ OF THE DIFFERENCES BETWEEN THE MALE AND FEMALE PELVIS.

- 319 In the *Male* pelvis the vertical diameters are the longest and the horizontal are the shortest.

In the *Female Pelvis* the antero-posterior and the transverse diameters are the longest and the vertical the shortest.

In *Short*, the Female pelvis is wider but lower;—whereas the male pelvis is narrower but higher.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE FEMUR.

- 320 They are:—1st, the head, articulating with the acetabulum and presenting a depression for the round ligament;—2d, the neck, which is intracapsular in front but extracapsular behind;—3d, the small trochanter;—4th, the anterior intertrochanteric line or spiral line;—5th, the great trochanter for the pelvic muscles;—6th, the digital depression for the internal obturator;—7th, the inner upper branch of rough line to great trochanter;—8th, the outer upper branch of rough line to great trochanter;—9th, the rough line of the femur for the adductor muscles;—10th, the inner lower branch of the rough line with the tubercle for the great adductor;—11th, the outer lower branch of the rough line;—12th, the condyles,—united in front—and separated behind by the intercondyloid notch for the spine of tibia and the insertion of the crucial ligaments;—13th, the outer tuberosity;—14th, the groove for the popliteus, and,—15th, the inner tuberosity with the tubercle for the tendon of the great adductor.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE PATELLA.

- 321 The *Posterior Surface*, the upper two-thirds of which are lined with articular cartilage; the lower third is not, and is out of the joint.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE TIBIA.

- 322 They are:—1st, the head presents the glenoid cavities;—2d, the spine of the tibia for the insertion of the cross ligaments;—3d, the internal tuberosity;—4th, the groove for the semi-membranous;—5th, the external tuberosity—6th, a facet articulating with the fibula;—7th, the tubercle of the tibia;—8th, the anterior border or shin;—9th, the external border or interosseous ridge;—10th, the space for popliteal muscle;—11th, the oblique line;—12th, the internal malleolus;—13th, the posterior grooves for the tendons;—14th, the facet for articulation with the fibula;—15th, the facet for articulation with the astragalus.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST
CONCERNING THE FIBULA.

- 323 They are:—1st, the head, presenting the styloid process and a facet articulating with the tibia;—2d, the neck;—3d, the internal border or interosseous ridge;—4th, the external malleolus,—a rough surface for the interosseous ligament;—an articular facet for the astragalus—and depressions for the lateral ligament.

RESUMÉ OF POINTS OF SPECIAL INTEREST
CONCERNING THE TARSUS.

- 324 The **First Row** comprises the Astragalus and the Calcaneum.

The *Astragalus* presents—a head articulating with scaphoid,—a neck,—facets for articulation with the tibia and malleoli and with the two upper facets of calcaneum;—a groove between these two facets for the interosseous ligament,—depression on the posterior surface for the external lateral ligament,—a groove for the long flexor of the great toe.

The *Calcaneum* presents—articular facets for the astragalus—a groove between the two;—the lesser process of the calcaneum,—the greater process of the calcaneum,—the inner tuberosity,—the outer tuberosity,—the tubercle (on external surface) for the external lateral ligament,—grooves for the peroneal muscles separated by a ridge.

- 325 The **Second Row** comprises the scaphoid, the three cuneiforms and the cuboid.

The *Scaphoid* presents—an anterior surface articulating with the astragalus;—articular surfaces for the three cuneiforms;—the tubercle of the scaphoid for the insertion of the tarsal ligament.

Cuneiforms. The *internal* cuneiform is the largest, the *middle* is the smallest, and the *external* the middle-sized one.

They present articular facets for articulation with the scaphoid, with one another and with the metatarsal bones.

The *Cuboid* presents articular facets for the calcaneum and the last two metatarsals;—a groove for the tendon of the long peroneal muscle.

Metatarsal Bones and Phalanges: Same as in the fingers.

LIGAMENTS.

- 326 **Structure.** The *Simple Fibrous* are formed of white tissue alone.

The *Fibro-Elastic* have more or less elastic fibres.

The *Elastic* are formed of elastic fibres alone (yellow elastic ligaments between the laminæ of the vertebræ).

The *Fibro-Cartilaginous* have more or less cartilaginous tissue in them (intervertebral discs).

The *Cartilaginous* have no fibres in them (synarthrodial joints).

SYNOVIAL AND SEROUS MEMBRANES IN GENERAL.

327 **Structure.** They are composed :

1st, of a *Basement Membrane* formed of connective tissue.

2d, of an *Epithelium* composed of tessellated cells.

Synovial membranes present adipose masses and vascular processes.

The *Adipose Masses*, at one time erroneously termed the Haversian glands,—consist simply of fat cells contained in a fold or projection of the synovial membrane.

The *Vascular Processes* present an analogous structure, but their bulk is formed of a great number of capillaries which give them their red coloration and cause them to resemble in structure the choroid plexuses of the cavities of the brain.

In these *Synovial Membranes* the endothelium and basement membrane stop where the cartilage begins.

In *Other Serous Membranes* the *Visceral Portion*, or the portion which invests the organs, consists only of the endothelium.

Synovial fluid contains lymph corpuscles.

CLASSIFICATION OF JOINTS.

328 1. **Synarthrodial.** *Sutures (seams)* *Dentated*: Tooth-like processes, as in interparietal sutures. *Serrated*: edges like teeth of a saw, as in interfrontal sutures. *Limbois*: beveled margins and dentated processes, as in the fronto-parietal suture.

Squamous have beveled margins overlapping each other, as in squamo-parietal.

Harmonic: opposition of contiguous rough surfaces, as in the intermaxillary suture.

Schindylesis: a border fitting in a groove, as vomer and sphenoid.

Gomphosis: teeth in their sockets.

2. **Diarthrodial.** *Enarthrodial* or *Ball and Socket*: shoulder and hip.

Condylod: temporo-maxillary, atlo-occipital.

Mutual Adaptation: trapezo-phalangeal, sterno-clavicular.

Ginglymoid or *Hinge-like*: elbow, knee.

Pirotal or *Rotary*: odontoid, radio-ulnar.

Arthrodial: facets in contact; articular processes of the vertebræ.

3. **Amphiarthrodial**: with *partial synovial* membrane (symphysis) *without synovial membrane* (bodies of vertebræ).

PECULIARITIES OR CHARACTERISTICS OF EACH KIND OF JOINT.

329 **Synarthrodial Joints or Immovable Joints.**

Are found only in the head.

Articular Surfaces: Vary according to location.

Ligaments: A cartilaginous substance between the bones.

Synovial Membrane: None.

Movements: None.

Diarthrodial or Movable Joints.

N. B.—The Articular Surfaces are all lined with cartilage.

Enarthrodial or Ball and Socket Joints.

(Scapulo-humeral, coxo-femoral.)

Articular Surfaces: On one of the bones, a socket with a fibro-cartilaginous rim; a head on the other bone.

Ligaments: A capsular ligament.

It always presents a *band of reinforcement* often called by a special name (coraco-humeral, ileo-femoral).

Muscular Ligaments: The joint is usually surrounded by short, strong muscles.

Synovial Membrane: Is usually well developed.

Movements: All the movements, flexion, extension, abduction, adduction, circumflexion, rotation on its axis.

Condylloid Joints.

(Temporo-maxillary articulation.)

Articular Surfaces: An elongated head on one bone and a similar cavity on the other.

Inter-Articular Fibro-Cartilage: Sometimes exists (temporo-maxillary).

Ligaments: Always capsular.

Sometimes presents a band of reinforcement.

Synovial Membrane: Is well developed.

It is sometimes divided into two by the cartilage.

Movements: All except the rotation on axis.

Mutual Adaptation Joints.

(Sterno-clavicular, trapezo-phalangeal.)

Articular Surfaces: They are concave in one direction and convex in the other, and are so opposed to each other as to adapt themselves to each other.

Inter-Articular Fibro-Cartilage: Is sometimes found (as in the sterno-clavicular).

Ligaments: A capsular ligament mainly.

Synovial Membrane: Is well marked.

Movements: All except rotation on axis.

Ginglymoid or Hinge-like Joints. (Elbow, knee.)

Articular Surfaces: On one bone, two prominences; on the other, two cavities.

Inter-articular Fibro-Cartilage: Exists in some.

Ligaments: Lateral ligaments, which are the strongest in

some situations, an anterior and a posterior more or less evident and strong.

Synovial Membrane: Is usually extensive.

Movements: Only flexion and extension.

Pivotal or Rotary Joints. (Odontoid, radio-ulnar.)

Articular Surfaces: A head with a sharp neck on one bone, and a partial cavity on the other.

Ligaments: Usually a strong band, the lower border of which is shorter than the upper so as to strangle the head as it were.

Muscular Ligaments: Usually a group of short, round muscles surround the joint.

Synovial Membrane: Is usually small.

Movements: Those of rotation of one-quarter of a circle.

Arthrodial Joints. (Articular processes of vertebræ.)

Articular Surfaces: Usually small facets, plane, or concave, or convex.

Ligaments: A short, limited capsule.

Synovial Membrane: Is very limited.

Movements: A mere gliding motion.

Amphiarthrodial Joints or Partly Movable Joints.

1st Variety: Amphiarthrodial Joints With Synovial Membrane (pubis, sacro-iliac).

Articular Surfaces: A small part only of the bones in contact is lined with cartilage; the larger part is rough for ligamentous attachments.

Ligaments: The most important is always a strong interosseous ligament—presents also more or less important peripheral ligaments.

Synovial Membrane: Is more limited.

Movements: Are very limited.

2d Variety: Amphiarthrodial Joints Without Synovial Membrane such as between the intervertebral discs.

Articular Surfaces: Are all rough.

Ligaments: Are strong bands of fibro-cartilaginous tissue.

Synovial Membrane: Is absent; however, the centre of the ligament presents a spot softer than the balance.

Movements: Are still more limited than in the other variety.

ARTICULATIONS OF THE BONES OF THE VERTEX OF THE SKULL.

- 330 They are all synarthrodials.
They are all serrated or dentated.

ARTICULATIONS OF THE BONES OF THE SIDES OF THE SKULL.

They are in the temporal fossa.
They are all synarthrodials.
They are all squamous.

ARTICULATIONS OF THE BONES AT THE BASE OF THE SKULL.

They are all synarthrodials.
They are all harmonic sutures.

ARTICULATIONS OF THE BONES OF THE FACE.

They are synarthrodials
They are all harmonic sutures.

ARTICULATIONS OF THE BONES OF THE UPPER JAW WITH THE BONES OF THE HEAD.

They are all synarthrodial.
They are slightly serrated.

RESUME OF THE IMPORTANT JOINTS.

ARTICULATION OF THE LOWER JAW WITH THE BONES OF THE HEAD OR TEMPORO- MAXILLARY ARTICULATION.

331 The Temporo-Maxillary.

Class: Condylod.

Articular Surfaces: *Glenoid Cavity* of temporal bone, *Condyle* of Inferior Maxillary,—*Inter-articular fibro-cartilage*.

Ligaments: *Capsular*, *External Lateral*,—*Internal Lateral* or spheno-maxillary (origin, spinous process of sphenoid; insertion, inner surface of ascending branch of inferior maxillary);—*Posterior Ligament* or *Stylo-maxillary* (origin, styloid process; insertion, angle of jaw);—*Pterygo-maxillary Ligament* (origin, pterygoid process; insertion, inner surface of ascending branch of maxillary).

Synovial Membrane: Is double, one above and one below the cartilage.

Movements: Flexion, extension, abduction, adduction, *i. e.*, all except rotation on axis.

ARTICULATIONS OF OCCIPITAL WITH ATLAS AND
AXIS.

- 332 These bones are joined by their bodies, their laminae, their articular surfaces.

The most interesting of all these are the articulations of the odontoid process with the atlas and the occipital.

They are:

Class: Pivotal.

Ligaments: All the most interesting ligaments are in the interior of the spinal canal.

1, Superficial occipito-axoid;—2, middle occipito-axoid;—3, deep occipito-transverse;—4, transverse ligament (Origin and Insertion, inner surface of occipital foramen);—5, axoido-transverse (completes the crucial ligament);—6, occipito-odontoid; 7, odonto-atloid (Insertion, to tubercle on inner surface of atlas).

ARTICULATIONS OF THE VERTEBRÆ.

- 333 The Vertebrae articulate by their bodies, their laminae; their articular processes are their spinous processes.

Ligaments: The most important ligaments are

1st. **Anterior Vertebral**, a strong fibrous band extending all along the anterior surface of the bodies of the vertebrae.

2d. The **Intervertebral Discs**, situated between the bodies and composed of strong fibro-cartilaginous fibres arranged in a semi-circular ring.—They are unique.

3d. The **Posterior Vertebral Ligament**, situated in the interior of the vertebral canal, is a fibrous band extending all along the posterior surface of the bodies.

4th. The **Yellow Elastic Ligaments** joining the laminae—they are thick and strong and thoroughly elastic.—They are unique.

5th. The **Capsular Ligaments** around the articular processes.

6th. The **Supra-Spinous Ligaments** joining the spinous processes.

ARTICULATIONS OF THE RIBS.

- 334 The articulations of the Ribs are all Amphiarthrodials.

The **Heads of the Ribs** articulate with the bodies of the vertebrae.

The **Ligaments** are an interosseous ligament extending from the ridge on the head to the intervertebral disc,—by an anterior fan-shape ligament.

The **Tuberosities of the Ribs** articulate with the apex of the transverse processes.

The **Ligaments** are—an interosseous ligament situated between the neck of the rib and the transverse process—a superior or castro-transverse ligament,—a posterior ligament.

The **Anterior Extremity of the Ribs** articulate with the chondral cartilages and are synarthrodial.

The **Chondral Cartilages** articulate with the sternum and are also synarthrodial.

ARTICULATION OF THE SACRUM AND COCCYX.

Is an arthrodial articulation.

The **Ligaments** are an anterior, a posterior and two laterals.

STERNO-CLAVICULAR ARTICULATION.

335 **Class:** Mutual adaptation.

Articular Surface: *Facets on Clavicle, facets on Sternum; Interarticular Cartilage.*

Ligaments: *Anterior, Posterior, Superior or Interclavicular.*

Movements: All except rotation on axis.

SCAPULO-HUMERAL.

336 **Class:** Enarthrodial, or ball and socket.

Articular Surfaces: *Glenoid Cavity* of scapula deepened by a fibro-cartilaginous ring around the margin;—*Head of Humerus.*

Ligaments: *Capsular* ligament and *Coraco-humeral*—Long head of biceps;—supra-spinous,—infra-spinous,—small round and subscapular muscles.

Synovial Membrane is very extensive.

Movements: All: flexion, extension, abduction, adduction, circumduction and rotation on its axis.

THE ELBOW JOINT.

337 **Divisions.** It comprises the articulation of the humerus with the radius and ulna, and the articulation of the upper extremity of the radius with the ulna.

ARTICULATION OF HUMERUS WITH ULNA AND RADIUS.

Class: Ginglymoid or hinge-like.

Articular Surfaces: *Humerus:* the trochlea and the small head of the humerus.—*Ulna:* great sigmoid notch formed by the olecranon process and coronoid process.—*Radius:* concave facet at upper extremity.

Ligaments: *Anterior and Posterior*, weak;—*Internal Lateral* (Origin, internal condyle; Insertion, two heads into olecranon process and coronoid process); *External Lateral* ligament (Origin, external condyle; Insertion, ligament of the radio-ulnar articulation).

Synovial Membrane: is extensive; sends a process under the triceps.

Movements: Flexion and extension.

UPPER ULNO-RADIAL ARTICULATION.

338 **Class:** Pivotal.

Articular Surfaces. *Ulna:* lesser sigmoid notch.—*Radius:* ring supporting the facet of the head.

Ligaments: *Semi-circular* ligament (Origin, in front of lesser sigmoid cavity; Insertion, behind it).—The upper border receives the fibres of the anterior and lateral ligaments of elbow,—the lower border is tightly drawn around the head and grasps it as it were.

Synovial Membrane: it always communicates with the elbow joint.

Movements: Pronation and supination.

LOWER ULNO-RADIAL ARTICULATION.

339 **Class:** Pivotal.

Articular Surfaces: A small convex facet on the head of the ulna—a small concave facet on the radius.

Ligaments are: Anterior strong—posterior strong also—a peculiar *triangular fibro-elastic ligament* or cartilage extending from the radius to the groove between the head of the ulna and the styloid processes.

Synovial Membrane: It does not communicate with that of the wrist.

Movements: Rotation of one-quarter of a circle.

WRIST JOINT.

340 **Division:** Comprises the articulations between the bones of the forearm themselves and with the bones of the first row of the carpus, also the articulations between the two rows.

1st. RADIO-CARPAL ARTICULATION.

Class: Condylod.

Articular Surfaces. *Forearm:* lower extremity of radius, triangular fibro-cartilage.—*Carpus:* scaphoid, semilunar, and pyramidal or cuneiform.

Ligaments: *Anterior* ligament, strong;—*External Lateral*, strong (Origin, styloid process of radius; Insertion, sca-

phoid);—*Internal Lateral* ligament, strong (Origin, styloid process of ulna; Insertion, pyramidal and pisiform).

Synovial Membrane: It communicates with all the articulations of the wrist.

Movements: Flexion, extension, abduction, adduction, circumduction.

2d. INTERCARPAL ARTICULATIONS.

341 **Class**: Condylod.

Articular Surfaces. *Upper Row*: cavity formed by scaphoid, semilunar and pyramidal.—*Lower Row*: head formed by great bone (os magnum).

Ligaments: *Anterior*, strong; *Posterior*, weak;—*External Lateral* (Origin, scaphoid; Insertion, trapezium);—*Internal Lateral* ligaments (Origin, pyramidal and pisiform; Insertion, cuneiform and fifth metacarpal).

Synovial Membrane communicates with all the others.

Movements: Same as radio-carpal, but more limited.

THE SACRO-ILIAC ARTICULATION.

342 **Class**: Amphiarthrodial.

Articular Surfaces. *Sacrum*: auricular facet.—*Ilium*: same.

Ligaments: *Interosseous*, very strong;—*Anterior*, weak;—*Large and Small Sacro-sciatic*;—*Posterior*, strong;—*Superior*, strong;—*Inferior*, strong.

Movements: Very limited.

THE SYMPHYSIS PUBIS ARTICULATION.

343 **Class**: Amphiarthrodial.

Articular Surfaces: A small facet lined with cartilage occupying the posterior part of the articular surfaces—in front of this a larger rough surface.

Ligaments: an interosseous strong—an anterior strong also—a posterior weak—a superior strong—an inferior arch-like ligament, strong.

Synovial Membrane: Is limited.

Movements: They are limited, but in pregnancy they increase, as also in the sacro-iliac articulation.

THE COXO-FEMORAL.

344 **Class**: Enarthrodial or ball and socket.

Articular Surfaces. *Innominate Bone*: acetabulum—deepened by fibro-cartilaginous ring,—presenting a back cavity not lined with articular cartilage.—*Femur*: the head presenting a pit deprived of cartilage.

Ligaments: *Capsular* (Origin, margin of acetabulum; Insertion in front to the anterior intra-trochanteric line; behind, it grasps the neck below the head like the radio-ulnar ligament);—*Ilio-femoral* (Origin, anterior inferior spinous process; Insertion, small trochanter);—*Round* ligament (Origin, margin of back of cavity of acetabulum; Insertion, pit in head of femur).

Synovial Membrane sometimes communicates with the serous bursa and the psoas-iliac.

Movements: Flexion, extension, abduction, adduction, circumduction and rotation.

KNEE JOINT OR TIBIO-FEMORAL.

345 **Class:** Ginglymoid or hinge-like.

Articular Surfaces. *Femur:* the two condyles united in front but separated behind.—*Tibia:* the two glenoid cavities separated by the spine of the tibia.—*Patella:* articular facets occupying the upper two-thirds of its posterior surface.—*Semilunar Fibro-cartilages.*

Ligaments: *Anterior* or *Patellar*, very strong (Origin, patella; Insertion, anterior tuberosity of tibia);—*Posterior* ligament, or ligament of Winslow, strong (Origin and Insertion, outer condyle of femur to inner tuberosity of tibia, and margin of condyles and tuberosities);—*External* ligament, strong and cord-like (Origin, outer condyle; Insertion, styloid process of fibula);—*Interosseous* or *Crucial ligaments* (Origin, inner surface of condyles; Insertion, in front and behind spine of tibia);—*Adipose ligaments* (Origin, patella; Insertion, spine of tibia);—*Internal* and *External Patellar* ligaments (capsular) (Origin, border of patella; Insertion, tuberosities of tibia).

Synovial Membrane is very extensive,—it sends a large process under the biceps—and also small ones under the patellar ligament.

Movements: Flexion and extension.

UPPER TIBIO-PERONEAL ARTICULATION.

346 **Class:** Arthrodial.

Articular Surfaces: Each bone presents a round facet.

Ligaments: They are: an anterior, strong; a posterior, strong.

Synovial Membrane: Sometimes communicates with that of the knee.

Movements: A gliding motion.

LOWER TIBIO-PERONEAL ARTICULATION.

Class: Amphiarthrodial.

Articular Surfaces: Each bone presents a small facet and a more extensive rough surface.

Ligaments: They are anterior strong and a posterior also strong.

Synovial Membrane: It also communicates with that of the ankle joint.

ANKLE JOINT OR TIBIO-TARSAL.

347 **Class:** Ginglymoid.

Articular Surfaces. *Leg:* lower extremity of tibia; internal malleolus; external malleolus.—*Foot:* three facets on astragalus.

Ligaments: *Anterior* and *Posterior*, weak;—*External Lateral*, strong (Origin, apex of malleolus; Insertion, astragalus in front and behind, calcaneum in middle);—*Internal Lateral*, ligament, strong (Origin, internal malleolus; Insertion, astragalus and calcaneum).

Synovial Membrane is extensive—it communicates with that of the lower tibio-peroneal articulation.

Movements: Flexion and extension.

ARTICULATIONS OF THE TARSUS.

348 1st. **Articulation of Astragalus and Calcaneum.**

Class: Arthrodial.

Articular Surfaces: Two facets on each bone.

Ligaments: *Interosseous*, strong (in grooves between the facets);—*Capsular*, weak (around the facets).

Synovial Membrane: It communicates with that of all the articulations of the tarsus.

Movements: Gliding motion.

ARTICULATION BETWEEN THE FIRST AND SECOND ROWS.

349 **Class:** Arthrodial.

Articular Surfaces: Facet on head of *Astragalus* articulating with scaphoid;—facet on *Calcaneum* articulating with cuboid.

Ligaments:

Dorsal Ligaments: Dorsal calcaneo-cuboid; interosseous or Y ligament (from calcaneum to cuboid and scaphoid); astragalo-scaphoid.

Internal Ligament: Calcaneo-scaphoid, *bridging over* head of astragalus; very strong.

Plantar Ligaments: Long plantar or calcaneo-cuboid; short plantar or calcaneo-cuboid.

Movements: Gliding motion.

350 **Articulations of the Metatarsal:** Are the same as those of the hands.

The great toe has no separate articulation.

MUSCLES.

RESUMÉ OF STRUCTURE OF THE MUSCULAR TISSUE.

There are two sorts of Muscular Fibres, the smooth muscular and the striped muscular fibres.

- 351 **Striped Muscular Fibres** are composed—1st, of an *Envelope* called the *Myolemma*;—2d, of a *Proper Substance* composed of *muscular fibrils*—composed themselves of minute particles called the *Sarcous Elements*;—3d, of *Capillaries* which run parallel with the muscular fibres.

Smooth Muscular Fibres are composed of fusiform nucleated cells, which unite together to form muscular fascicles or bundles.

RESUMÉ OF THE STRUCTURE OF TENDONS.

- 352 Tendons are composed of an *Envelope*,—of bundles of *dense connective tissue*,—of *elastic fibres*,—of *connective tissue corpuscles*.

APONEUROSES OR FASCIÆ.

- 353 **Structure.** They are formed of fine bundles of connective tissue.

RESUMÉ OF MUSCLES (ORIGIN, INSERTION AND ACTION).

MUSCLES OF THE HEAD.

CRANIAL REGION.

- 354 **Occipito-frontal:** *Origin*, superior curved line of occipital; *Insertion*, skin over eyebrow.

AURICULAR REGION.

Anterior Auricular: *Origin*, zygoma; *Insertion*, helix.

Posterior Auricular: *Origin*, mastoid process; *Insertion*, concha.

Superior Auricular: *Origin*, temporal fascia; *Insertion*, concha.

PALPEBRAL REGION.

Palpebral Orbicular: *Origin*, direct tendon, from nasal process of superior maxilla; reflected tendon, from crest of lachrymal bone; *Insertion*, skin of outer region of eyelid.

Tensor of the Tarsal Cartilages: *Origin*, membrane of lachrymal sac; *Insertion*, lachrymal points.

Superciliary or Contractor of the Eyebrows: *Origin*, superciliary ridge; *Insertion*, skin of the eyebrow.

NASAL REGION.

355 **Pyramidal:** *Origin*, nasal bone; *Insertion*, skin between the eyebrows.

Common Elevator of Wing of Nose and Upper Lip: *Origin*, nasal process; *Insertion*, wing of nose and skin of upper lip.

Dilator of the Nostrils: *Origin*, median cartilage of nose; *Insertion*, wing of nostrils.

Compressor of Nostrils: *Origin*, incisive fossa of superior maxilla; *Insertion*, skin of septum and wings of nostrils.

BUCCAL OR ORAL REGION.

356 1st. **Orbicular Muscle:** *Origin and Insertion*, skin.

2d. **Elevators of Upper Lip, Common Elevator** (see above), **Proper Elevator:** *Origin*, margin of orbit; *Insertion*, skin of lip.

3d. **Elevator of the Commissures: Small Zygomatic:** *Origin*, malar bone; *Insertion*, skin of lip.

Great Zygomatic: *Origin*, malar bone and zygoma; *Insertion*, skin of lip.

4th. **Proper Elevator of Commissure or Canine Muscle:** *Origin*, canine fossa; *Insertion*, skin of lip.

5th. **Retractors of the Commissures: Risorius:** *Origin*, formed by the highest fibres of the platysma; *Insertion*, skin of lip.

Buccinator: *Origin*, pterygo-maxillary ligament, alveolar processes of the two maxillæ; *Insertion*, skin of angle of mouth.

6th. **Depressor of the Commissure: Triangular Muscle:** *Origin*, oblique line of inferior maxilla; *Insertion*, skin of angle.

7th. **Depressor of the Lower Lip: Square Muscle of Chin:** *Origin*, base of inferior maxilla; *Insertion*, skin of lip.

8th. **Elevator of the Lower Lip:** *Origin*, symphysis of maxilla; *Insertion*, skin of lip.

TEMPORO-MAXILLARY REGION.

357 **Masseter:** *Origin*, zygoma and malar bone; *Insertion*, outer surface of vertical branch of lower maxilla. *Action*, elevates lower jaw.

Temporal: *Origin*, temporal fossa; *Insertion*, coronoid process of inferior maxilla. *Action*, same.

PTERYGO-MAXILLARY REGION.

External Pterygoid: *Origin*, inferior surface of wing of sphenoid and external surface of pterygoid process; *Inser-*

tion, depression in neck of condyle. *Action*, causes the grinding motion of the jaw.

Internal Pterygoid: *Origin*, pterygoid fossa; *Insertion*, inner surface of vertical branch of inferior maxilla. *Action*, same.

MUSCLES OF NECK.

SUPERFICIAL REGION.

- 358 1st. **Platysma:** *Origin*, oblique line of inferior maxilla and skin of angle; *Insertion*, skin over the clavicle. *Action*, stretches the skin of the neck.

Sterno-cleido Mastoid: *Origin*, sternum and internal extremity of clavicle; *Insertion*, mastoid process. *Action*, rotates the face to the opposite side; when both act they extend the head.

SUPRA-HYOID REGION.

- 359 **Digastric:** *Origin*, digastric groove of occipital; *Insertion*, inner surface of inferior maxilla. It pierces the tendon of the stylo-hyoid where this is attached to the hyoid bone. *Action*, raises the larynx.

Stylo-hyoid: the name indicates origin and insertion.

Mylo-hyoid: *Origin*, internal oblique line of inferior maxilla; *Insertion*, hyoid bone. *Action*, raises the larynx.

Genio-hyoid: *Origin*, inferior genial tubercle of inferior maxilla; *Insertion*, hyoid bone. *Action*, raises the larynx.

INFRA-HYOID REGION.

Sterno-hyoid, Sterno-thyroid, Thyro-hyoid, Omo-hyoid; The names indicate origin and insertion. They are depressors of the larynx and jaw.

ANTERIOR VERTEBRAL REGION.

- 360 **Large Anterior Strait:** *Origin*, tubercles of transverse processes of the four upper cervical vertebræ; *Insertion*, basilar process of occipital bone.

Small Anterior Strait: *Origin*, transverse process of atlas; *Insertion*, basilar process of occipital.

Lateral Strait: *Origin*, transverse process of atlas; *Insertion*, jugular process of occipital.

Long Cervical Muscle—Inner Portion: *Origin*, bodies of upper cervical vertebræ; *Insertion*, bodies of upper dorsal vertebræ. *Action*, all act as active ligaments.

Lower Portion: *Origin*, bodies of dorsal vertebræ; *Insertion*, transverse processes of fifth and sixth cervical vertebræ.

Upper Portion: *Origin*, transverse processes of upper cervical vertebræ; *Insertion*, tubercle on anterior surface of atlas.

LATERAL VERTEBRAL REGION.

- 361 **Anterior Scalene:** *Origin*, anterior tubercles of four upper cervical vertebræ; *Insertion*, tubercle on first rib.
Middle Scalene: *Origin*, posterior tubercles of cervical vertebræ; *Insertion*, first rib, behind groove for subclavian artery.
Posterior Scalene: *Origin*, posterior tubercles of cervical vertebræ; *Insertion*, second rib.

MUSCLES OF BACK.

FIRST LAYER.

- 362 **Trapezius:** *Origin*, superior curved line of occipital nuchal ligament, spinous processes of dorsal vertebræ; *Insertion*, spine of scapula; posterior convexity of clavicle. *Action*, raises the shoulder by its upper fibres and depresses it by its lower fibres; when both muscles act, the shoulders are drawn towards the spine. The upper fibres rotate the head to the opposite side; the two sides acting simultaneously extend the head.
Great Dorsal: *Origin*, crest of ilium, spinous processes of sacrum and lumbar vertebræ, lower ribs; *Insertion*, bicipital groove of the humerus. *Action*, adducts the arm.

SECOND LAYER.

- Elevator of Scapula:** *Origin*, transverse processes of three upper cervical vertebræ; *Insertion*, upper part of spinal border of scapula.
Rhomboid: *Origin*, spinous processes of lower cervical and upper dorsal vertebræ; *Insertion*, lower portion of the spinal border of the scapula. *Action*, raises the lower angle of the scapula.
Inferior Serrate: *Origin*, spinous process of lower dorsal and upper lumbar vertebræ; *Insertion*, lower ribs (body). *Action*, depresses the lower ribs.

THIRD LAYER.

- Splenious** (spinous occipito-transverse): *Origin*, spinous processes of six upper dorsal and two lower cervical; *Insertion*, transverse processes of three upper cervical and outer portion of rough space of occipital bone. *Action*, rotates the head to the same side.
Superior Serrate: *Origin*, spinous process of last two cervical and upper two dorsal vertebræ; *Insertion*, body of upper ribs. *Action*, raises the upper ribs.

FOURTH LAYER.

- 363 **Complexus** (or transverso-occipito-mastoid): *Origin*, transverse processes of five upper dorsal and four lower

cervical; *Insertion*, inner half of rough surface of *occipital* bone, a portion being attached to the mastoid process (lesser complexus or trachelo-mastoid).

Cervical Digastric (biventer cervicis) is the inner portion of the complexus, which presents a tendinous portion in its middle part. *Action*, extends the head and rotates it to the same side.

Spinal Erector: 1st, **Common Mass**: *Origin*, sacro-iliac gutter; *Insertion*, divides into sacro-lumbal and long dorsal; 2d, **Sacro-lumbal** (or *ilio-costal*): *Ascending portion*: *Origin*, crest of ilium; *Insertion*, ribs near angle; *Accessory or Descending portion* (same insertion); *Ascending cervical* (or *costo-transverse*): *Origin*, angle of four upper ribs; *Insertion*, transverse processes (posterior tubercles) of three lower cervical vertebræ; 3d, **Long Dorsal** (or sacro-transverso-costal): 1st, is prolonged into the neck as the *Transverse Cervical*: *Origin*, transverse processes of six upper dorsal vertebræ; *Insertion*, transverse processes of six lower cervical vertebræ; 2d, **Dorsal Spinous**: *Origin*, spinous processes of the two upper lumbar and two lower dorsal; *Insertion*, eight upper dorsal spinous processes; 3d, **Semi-spinal of Back** (under the dorsal spinous) is prolonged into the neck (which is under the complexus); *Origin*, transverse processes of lower dorsal vertebræ; *Insertion*, spinous processes of upper dorsal vertebræ; 4th, **Semi-spinal of Neck** is under the complexus; *Origin*, transverse processes of the four upper dorsal vertebræ and articular processes of the lower four cervical vertebræ; *Insertion*, spinous processes of four upper cervical vertebræ.

FIFTH LAYER.

364 **Multifid or Transverse Spinal or Rotator Muscle of Spine**. *Origin*, transverse processes; *Insertion*, spinous processes.

Large Posterior Straight: *Origin*, spinous processes of axis; *Insertion*, lower rough surface of the occipital; *Action*, is an active ligament.

Small Posterior Straight: *Origin*, spinous process of atlas; *Insertion*, same but inner portion; *Action*, the same.

Inferior or Great Oblique or Atlo-axoid: *Origin*, spinous processes of axis; *Insertion*, transverse process of atlas. *Action*, rotates the head.

Superior or Small Oblique or Atlo-occipital: *Origin*, transverse process of atlas; *Insertion*, occipital bone behind; *Action*, the same.

Interspinal (in neck only): between the *spinous* processes.

Intertransverse Muscles between transverse processes: are active ligaments.

Extensor of Coccyx: *Origin*, sacrum; *Insertion*, coccyx.

MUSCULAR LAYERS OF NECK.

365 (Posterior Cervical Region.)

FIRST LAYER.

Trapezius.

SECOND LAYER.

Elevator of Scapula ; Splenius.

THIRD LAYER.

1st, **Complexus** (comprising trachelo-mastoid and cervical digastric); 2d, **Transverse Cervical**; 3d, **Ascending Cervical**.

FOURTH LAYER.

1st, **Cervical Spinous**; 2d, **Posterior Straight and Oblique Muscles**.

FIFTH LAYER.

1st, **Semi-spinal of neck** or cervical portion of multifid. muscle; 2d, **Supra-spinous** (in neck only); 3d, **Inter-spinous**; 4th, **Intertransverse muscles**.

MUSCLES OF THE CHEST.

366 **Great Pectoral Muscle**: *Origin*, sternum, middle ribs; anterior convexity of clavicle; *Insertion*, bicipital groove of the humerus (outer edge); *Action*, adducts the arm.

Small Pectoral: *Origin*, external surface of the third, fourth and fifth ribs; *Insertion*, coracoid process; *Action*, depresses the outer angle of the scapula, and raises the upper ribs.

Subclavian Muscle: *Origin*, under surface of the clavicle; *Insertion*, first rib.

Great Serrate Muscle: *Origin*, external surface of the upper eight ribs; *Insertion*, spinal border of the scapula. *Action*, draws the scapula forwards or raises the ribs.

Intercostals: *Origin*, the border of the rib above; *Insertion*, the border of the rib below.

N. B.—The *External Intercostals* start from the transverse processes of the vertebræ and do not reach the anterior extremities of the ribs. The *Internal Intercostals* start from the angle of the ribs and reach the sternum. *Action*, when the first rib is fixed they are inspirators; when the last rib is fixed they are expirators.

Supra-costals: *Origin*, apex of transverse processes of vertebræ; *Insertion*, second rib below; *Action*, raise the ribs.

Infra-costals (are inside the chest): *Origin*, surface of the rib from the angle to the tuberosity; *Insertion*, second rib below; *Action*, same as the intercostals.

Triangle Sternal Muscle: *Origin*, ensiform cartilage and the sternum; *Insertion*, the third, fourth, fifth and the sixth costal cartilages; *Action*, unknown.

MUSCLES OF THE SHOULDER.

- 367 **Deltoid:** *Origin*, anterior concavity of the clavicle, acromion, and spine of scapula; *Insertion*, V-shaped surface or deltoid eminence of the humerus; *Action*, abducts the arm.
- Supra-spinous:** *Origin*, supra-spinous fossa; *Insertion*, upper surface of greater tuberosity of humerus; *Action*, the same; is especially an active ligament.
- Infra-spinous:** *Origin*, infra-spinous fossa; *Insertion*, middle surface of the greater tuberosity of the humerus; *Action*, rotates the arm outwards.
- Small Round:** *Origin*, middle of axillary border of the scapula; *Insertion*, lower surface of the greater tuberosity of the humerus; *Action*, rotates the arm outwards.
- Great Round:** *Origin*, axillary border of scapula near lower angle; *Insertion*, posterior ridge of the bicipital groove of the humerus; *Action*, it rotates the arm inwards; is also an adductor.
- Subscapular:** *Origin*, subscapular fossa; *Insertion*, smaller tuberosity of humerus; *Action*, it rotates the arm inwards; is also an active ligament.

MUSCLES OF THE ARM—MUSCLES OF ANTERIOR REGION OF THE ARM.

- 368 **Coracho-brachial:** *Origin*, coracoid process; *Insertion*, border of the humerus (middle). *Action*, draws the arm forward.
- Biceps:** *Origin*, long head, apex of glenoid cavity of scapula; short head, coracoid process; *Insertion*, bicipital tubercle of radius (back part). *Action*, flexes the arm and supinates the forearm.
- Anterior Brachial:** *Origin*, lower half of anterior surface of humerus; *Insertion*, base of coronoid process of the ulna. *Action*, flexes the arm.

MUSCLES OF THE POSTERIOR REGION OF THE ARM.

- 369 **Triceps:** *Origin*, long head; axillary border of scapula below glenoid cavity; external head (external vast): posterior surface of humerus above spiral groove; internal head (internal vast); posterior surface of the humerus below spiral groove; *Insertion*, base of olecranon process of the ulna. *Action*, extends the forearm.
- Subanconeus:** *Origin*, lower part of the posterior surface of humerus; *Insertion*, synovial membrane; *Action*, draws the synovial membrane from between the bony surfaces.

MUSCLES OF THE FOREARM.

MUSCLES OF THE ANTERIOR REGION OF THE FOREARM.

SUPERFICIAL LAYER.

370 **Round Pronator:** *Origin*, inner condyle of the humerus; *Insertion*, outer surface of radius.

Radio-carpal Flexor: *Origin*, inner condyle of humerus; *Insertion*, base of second metacarpal bone.

Long Palmar (or middle radio-carpal flexor): *Origin*, inner condyle of the humerus; *Insertion*, anterior annular ligament.

Ulna-carpal Flexor: *Origin*, inner condyle of the humerus and olecranon process of the ulna; *Insertion*, pisiform bone.

MIDDLE LAYER.

Superficial Common Flexor of Fingers: *Origin*, inner condyle of the humerus, coronoid process of ulna and oblique line of the radius; *Insertion*, lateral borders of second phalanges.

DEEP LAYER.

Deep Common Flexor: *Origin*, anterior surface of ulna (upper three-fourths); *Insertion*, bases of the third phalanges.

Long Flexor of Thumb: *Origin*, anterior surface of radius (upper three-fourths); *Insertion*, base of last phalanx of thumb.

Square Pronator: *Origin*, anterior surface of ulna (lower fourth); *Insertion*, anterior surface of radius (lower fourth).

MUSCLES OF EXTERNAL OR RADIAL REGION OF THE FOREARM.

371 **Long Supinator:** *Origin*, upper part of outer border of humerus; *Insertion*, styloid process of radius.

Long Radio-carpal Extensor: *Origin*, lower part of the outer border of the humerus; *Insertion*, back of base of the second metacarpal bone.

Short Radio-carpal Extensor: *Origin*, external condyle of humerus; *Insertion*, back of the base of the third metacarpal bone.

Short Supinator: *Origin*, external condyle of the humerus; *Insertion*, upper fourth of the shaft of the radius.

MUSCLES OF POSTERIOR REGION OF THE FOREARM.

SUPERFICIAL LAYER.

- 372 **Anconeus**: *Origin*, external condyle of the humerus; *Insertion*, upper fourth of the outer surface of the ulna.
Common Extensor of Fingers: *Origin*, the outer condyle of the humerus; *Insertion*, by a middle slip into the bases of the second phalange and by two lateral slips into the bases of the last phalanges.
Extensor of Little Fingers: *Origin*, outer condyle of the humerus; *Insertion*, unites with the fourth tendon of the common extensor.
Ulnocarpal Extensor: *Origin*, outer condyle of the humerus and posterior surface of ulna (middle); *Insertion*, base of fifth metacarpal bone.

DEEP LAYER.

- 373 **Extensor of Metacarpal Bone of Thumb or Long Abductor**: *Origin*, middle of ulna, interosseous membrane, lower part of radius; *Insertion*, base of the metacarpal bone of the thumb.
Extensor of First Phalanx of Thumb: *Origin*, middle of ulna, interosseous membrane, lower part of radius; *Insertion*, base of first phalanx.
Extensor of Second Phalanx of Thumb: *Origin*, middle of ulna; *Insertion*, the base of the second phalanx.
Extensor of Index Finger: *Origin*, middle of the ulna and interosseous membrane; *Insertion*, base of the last phalanx.

MUSCLES OF THE HAND—MUSCLES OF EXTERNAL OR RADIAL OR THENAR REGION.

- 374 **Abductor of Thumb**: *Origin*, annular ligament and trapezium; *Insertion*, outer part of the first phalanx.
Opposing or Opponens: *Origin*, annular ligament and trapezium; *Insertion*, outer border of first metacarpal bone.
Short Flexor of Thumb: *Origin*, anterior head: annular ligament, trapezium and scaphoid; posterior head: os magnum, trapezoid, and base of the third metacarpal; *Insertion*, outer and inner tubercles of the first phalanx of the thumb.
Adductor of the Thumb: *Origin*, the third metacarpal bone; *Insertion*, inner tubercle of the first phalanx.

MUSCLES OF THE INTERNAL OR ULNAR OR HYPOTHENAR REGION.

- 375 **Short or Small Palmar Muscle**: *Origin*, annular ligament; *Insertion*, the skin.

Adductor of Little Finger: *Origin*, annular ligament and pisiform bone; *Insertion*, outer tubercle of the base of first phalanx of little finger.

Short Flexor of Little Finger: *Origin*, annular ligament and pisiform bone; *Insertion*, outer tubercle of the base of the first phalanx.

Flexor of the Metacarpal Bone of the Little Finger, or Opponens: *Origin*, unciform process; *Insertion*, inner border of fifth metacarpal bone.

MUSCLES OF THE MIDDLE OR PALMAR REGION.

376 **Lumbrical Muscles:** *Origin*, tendons of the deep flexor; *Insertion*, extensor tendons of the finger; *Action*, assists interosseous muscles in extending the fingers.

Interosseous Muscles: *Origin*, lateral surfaces of metacarpal bones; *Insertion*, base of the first phalanx; *Action*, abductors and adductors.

MUSCLES OF EXTERIOR OF THE ABDOMEN.

377 **Great Oblique or External Oblique:** *Origin*, iliac crest, Poupart's ligament, superior spinous process, spine and angle of the pubis; *Insertion*, linea alba, outer surface of the eight lower ribs; *Action*, compresses the viscera, depresses the lower ribs.

Small or Internal Oblique: *Origin*, iliac crest, Poupart's ligament, crest of pubis; *Insertion*, linea alba, free border of the costal cartilages of the asternal ribs; *Action*, the same.

Transverse: *Origin*, lumbar aponeurosis and through it to the spinous and transverse processes of the lumbar vertebrae, iliac crest, crest of pubis; *Insertion*, linea alba, internal surface of the eight lower ribs and their cartilages; *Action*, the same.

Abdominal Straight: *Origin*, crest of pubis; *Insertion*, outer surface of the cartilages of the middle ribs; *Action*, same; flexes the trunk.

Pyramidal: *Origin*, crest of pubis; *Insertion*, linea alba; *Action*, is the tensor of the linea alba.

MUSCLES OF THE INTERIOR OF THE ABDOMEN.

378 **Diaphragm:** *Origin*, bodies of first four lumbar (the right or anterior pillar descends to the fourth, the left or posterior pillar reaches only the third); internal and external arcuate ligaments; inner surface of the asternal ribs and of the false ribs; *Insertion*, cordiform tendon; *Action*, increases the depth of the chest and raises the lower ribs.

Square Lumbar: *Origin*, iliac crest, ilio-lumbar ligament,

transverse processes of the lumbar vertebræ; *Insertion*, last rib; *Action*, depresses the lower rib or steadies it.

Small Psoas: *Origin*, bodies of last dorsal and first lumbar vertebræ; *Insertion*, ilio-pectineal eminence; *Action*, is the tensor of the iliac fascia.

Large Psoas Muscle: *Origin*, bodies and transverse processes of last dorsal and all the lumbar vertebræ; *Insertion*, small trochanter of femur; *Action*, flexes the thigh and rotates it outwards.

Iliac Muscle: *Origin*, iliac fossa; *Insertion*, small trochanter; *Action*, the same as psoas.

MUSCLES OF ANTERIOR REGION OF THIGH.

379 **Tensor of Femoral Fascia:** *Origin*, anterior superior spine of the ilium; *Insertion*, femoral fascia.

Sartorius: *Origin*, anterior superior spinous process of the ilium; *Insertion*, upper part of crest of tibia; *Action*, flexes the leg and crosses it in front of the other leg; it flexes the thigh also.

Quadriceps Extensor:

1st. **Straight:** *Origin*, anterior inferior spinous process of the ilium and adjoining groove; *Insertion*, patella and tubercle of the tibia; *Action*, extends the leg.

2d. **External Vast:** *Origin*, root of great trochanter, rough line and outer lower branch of this rough line; *Insertion*, tendon of straight muscle and outer border of the patella.

3d. **Internal Vast:** *Origin*, inner surface of the femur, rough line and inner lower branch of this line; *Insertion*, tendon of straight muscle and inner border of the patella.

4th. **Crureus:** anterior surface of the femur; *Insertion*, upper border of the patella.

Sub-Crureus: *Origin*, lower part of anterior surface of the femur; *Insertion*, synovial capsule.

MUSCLES OF THE INTERNAL REGION OF THE THIGH.

380 **Gracilis:** *Origin*, branches of the pubis and ischium; *Insertion*, crest of the tibia; *Action*, is an adductor of the thigh and a flexor of the leg.

Pectineus: *Origin*, ilio-pectinal line; *Insertion*, line from small trochanter to rough line; *Action*, is an adductor and a rotator outwards.

Long Adductor: *Origin*, anterior surface of the pubis; *Insertion*, middle third of the rough line of the femur.

Short or Small Adductor: *Origin*, anterior surface of the pubis; *Insertion*, upper third of rough line of femur.

Great Adductor: *Origin*, anterior surface of the branches of the pubis and ischium and internal borders of the tuber-

osity of the ischium; *Insertion*, whole of rough line and tubercle on inner condyle of the femur.
Action, they adduct the thigh.

MUSCLES OF THE ANTERIOR REGION OF THE LEG.

381 **Anterior Tibial Muscle**: *Origin*, upper two-thirds of the outer surface of the tibia; *Insertion*, inner cuneiform bone. *Action*, flexes the foot and turns its inner border upwards.

Extensor Muscle of Great Toe: *Origin*, middle third of fibula and interosseous membrane; *Insertion*, base of the second phalanx of great toe.

Long Extensor of the Toes: *Origin*, upper two-thirds of fibula and interosseous membrane; *Insertion*, base of the second and third phalanges.

Third or Small Peroneal: *Origin*, is a division of the long extensor of the toes; *Insertion*, base of the last metatarsal bone; *Action*, flexes the foot and turns the outer border upwards.

MUSCLES OF THE EXTERNAL REGION OF LEG.

382 **Short Peroneal**: *Origin*, lower half of fibula; *Insertion*, base of last metatarsal bone; *Action*, extends the foot.

Long Peroneal: *Origin*, upper half of the fibula; *Insertion*, base of the first metatarsal bone; *Action*, extends the foot and turns the outer border of the foot upwards.

MUSCLE OF DORSAL REGION OF FOOT.

383 **Short Extensor of the Toes**: *Origin*, calcaneum and cuboid; *Insertion*, tendon of the long extensor of the toes.

MUSCLES OF THE GLUTEAL REGION.

384 **Great Gluteal**: *Origin*, iliac crest, posterior sacro-sciatic ligament, sacrum and coccyx; *Insertion*, crural fascia and outer branch of rough line of femur; *Action*, rotates the thigh outwards and supports the trunk upon the femur.

Middle Gluteal: *Origin*, between the two curved lines of innominate bone; *Insertion*, outer surface of great trochanter; *Action*, the same.

Small Gluteal: *Origin*, below the inferior curved line; *Insertion*, interior border of the great trochanter; *Action*, rotates the thigh inwards.

Pyriform: *Origin*, anterior surface of the sacrum; *Insertion*, upper border of great trochanter; *Action*, rotates the thigh outwards.

Superior Gemellar: *Origin*, spine of ischium; *Insertion*,

tendon of internal obturator; *Action*, rotates the thigh outwards.

Inferior Gemellar: *Origin*, tuberosity of the ischium; *Insertion*, tendon of internal obturator; *Action*, the same.

Internal Obturator: *Origin*, inner surface of obturator membrane and margin of obturator foramen; *Insertion*, upper border of the great trochanter; *Action*, the same.

Square Femoral: *Origin*, tuberosity of the ischium; *Insertion*, posterior border of the great trochanter; *Action*, the same.

External Obturator: *Origin*, outer surface of obturator membrane and margin of obturator foramen; *Insertion*, digital fossa on inner surface of great trochanter; *Action*, the same.

MUSCLES OF THE POSTERIOR REGION OF THE THIGH.

385 **Biceps:** *Origin*, long head, tuberosity of the ischium; short head, middle third of rough line of femur; *Insertion*, head of the fibula; *Action*, flexes the leg.

Semi-tendinous: *Origin*, tuberosity of the ischium; *Insertion*, anterior tuberosity of tibia; *Action*, flexes the leg.

Semi-membranous: *Origin*, tuberosity of ischium; *Insertion*, 1st, through Winslow's ligament to external condyle of femur; 2d, posterior surface of head of the tibia; 3d, groove on inner tuberosity of the tibia; *Action*, flexes the leg.

MUSCLES OF THE POSTERIOR REGION OF THE LEG.

SUPERFICIAL LAYER.

386 **Gastrocnemius:** *Origin*, by two heads above the condyles of the femur; *Insertion*, tendon of Achilles.

Soleus: *Origin*, outer head: upper third of the posterior surface of fibula; inner head: oblique line of the tibia; *Insertion*, tendon of Achilles and through it to the calcaneum.

Plantaris: *Origin*, outer condyle of the femur; *Insertion*, inner border of the tendon of Achilles; *Action*, extends the foot.

DEEP LAYER.

Popliteal: *Origin*, groove on outer surface of the outer condyle of the femur; *Insertion*, posterior surface of the tibia above oblique line; *Action*, flexes the leg; it is an active ligament.

Long Flexor of Toes: *Origin*, posterior surface of the tibia; *Insertion*, bases of the last phalanges.

Posterior Tibial: *Origin*, interosseous membrane, tibia and

fibula; *Insertion*, scaphoid and inner cuneiform bone; *Action*, extends the foot and turns its inner border upwards.

Long Flexor of Great Toe: *Origin*, posterior surface of the fibula; *Insertion*, base of the second phalanx.

MUSCLES OF THE FOOT.—MUSCLES OF THE INTERNAL REGION—MUSCLES OF GREAT TOE.

387 **Adductor of Great Toe:** *Origin*, internal tuberosity of calcaneum, internal cuneiform and first metatarsal; *Insertion*, inner side of the first phalanx.

Short Flexor of Great Toe: *Origin*, cuboid and external cuneiform bones; *Insertion*, base of the first phalanx by two tendons.

Adductor of Great Toe: *Origin*, calcaneo-cuboid ligament, base of the second and third metatarsal; *Insertion*, outer side of base of first phalanx.

Transverse Muscle: Anterior extremities of metatarsal bones; *Insertion*, outer side of base of the first phalanx.

MUSCLES OF THE EXTERNAL PLANTAR REGION.—MUSCLES OF THE LITTLE TOE.

388 **Abductor of Small Toe:** *Origin*, calcaneum and fifth metatarsal; *Insertion*, outer side of base of last phalanx.

Short Flexor of Small Toe: *Origin*, cuboid and fifth metatarsal; *Insertion*, base of the first phalanx.

MUSCLES OF THE MIDDLE PLANTAR REGION.

389 **Short Flexor:** *Origin*, calcaneum and internal annular ligament; *Insertion*, borders of the second phalanges.

Accessory Flexor: *Origin*, calcaneum; *Insertion*, outer border of tendons of long flexor of toes.

Lubricals: *Origin*, angle of tendons of long flexor of toes; *Insertion*, inner side of the first phalanges.

Interosseous: *Origin*, lateral surface of metatarsal bones; *Insertion*, bases of first phalanges of toes.

PECULIARITIES OF THE MUSCLES IN PARTICULAR.

(*Ninety-two Muscles.*)

390 Flexor Muscles are always more numerous.

MUSCLES OF THE BACK.

The **Trapezius** is remarkable for its large surface.

The **Great Dorsal** also.

The **Complexus** originates from the transverse processes, and is inserted in the occipital close to the middle line; it is the reverse with most of the other muscles of the region.

The **Cervical Digastric** is one of the few double-bellied muscles. The others are the digastric, the great oblique of the eyeball, the occipito-frontal, the omo-hyoid.

The **Spinal Erector** is remarkable for the multiplicity of its insertions through fasculi which are attached to all the bony prominences of the back: spinous processes, transverse processes, articular processes, neck of the ribs, angles of ribs.

The **Posterior Straight and Oblique Muscles** are really the active ligaments of the articulations of the head with the vertebral column.

CRANIAL REGION.

The **Occipito-frontal** is the largest double-bellied muscle.

It is separated from the periosteum by a loose layer of connective tissue which forms a real serous bursa.

Its origin is bony; its insertion is cutaneous.

MUSCLES OF THE FACE.

All the muscles of the face and of the cranial region, except the **Masseter**, are cutaneous muscles; that is, they have a bony origin and a cutaneous insertion.

All such cutaneous muscles (including the platysma of the neck) are supplied by the facial nerve.

All the muscles of the face form groups around the orifices, and are dilators or constrictors of those orifices.

The **Orbicular Muscle of the Lips** is the only thoroughly cutaneous muscle, since it is not connected with bone at any point.

The **Palpebral Orbicular** is noticeable for its action, which spreads the tears over the cornea and at the same time directs them towards the lachrymal lake at the inner angle, where they are absorbed by the lachrymal points.

The **Buccinator** is perforated by Steno's Duct.

TEMPORO-MAXILLARY REGION.

The **Masseter** is the only muscle forming a part of the face which is not a cutaneous muscle; it is supplied by the fifth pair.

The **Temporal** is remarkable for its strength, for its unique insertion in the strong coronoid process, for its encasement in a fibro-osseous fossa.

PTERYGO-MAXILLARY REGION.

The **External Pterygoid** :

Has two heads, between which is found the internal maxillary artery.

It is inserted also into the fibro-cartilage of the temporo-maxillary articulation and compels that cartilage to follow the movement forward of the condyle.

MUSCLES OF THE SUPERFICIAL REGION
OF THE NECK.

- 391 The **Platysma** is the largest cutaneous muscle, containing the most muscular fibres.

The **Sterno-cleido Mastoid** :

Is a most important surgical muscle.

It divides the side of the neck into two large triangles.

Its relations with the large vessels of the neck are of the greatest importance, as will be described in the surgical anatomy of the neck.

MUSCLES OF THE SUPRA-HYOID REGION.

The **Digastric** :

Is one of the four double-bellied muscles.

It gives its name to a surgical region, the digastric triangle.

The **Stylo-hyoid** is noticeable because its tendons are perforated by the Digastric.

The **Mylo-hyoid** forms the floor of the mouth; all that is below it is outside of the mouth; all that is above it is in the mouth.

Its fibres cross to the other side.

It forms a sort of diaphragm.

The **Genio-hyoid** is above the mylo-hyoid, *i. e.*, inside the mouth.

MUSCLES OF THE INFRA-HYOID REGION.

The **Sterno-hyoid** is a guide in tracheotomy.

The **Omo-hyoid** :

Is a double-bellied muscle.

It is remarkable for its irregular course.

It is connected in its middle with the cervical fascia, which is itself adhered to the Subclavian vein.

MUSCLES OF THE CHEST.

The **Great Pectoral** :

Is remarkable for its size, shape, structure.

Its lower border forms the anterior boundary of the axilla.

The **Small Pectoral** divides the course of the axillary vessels into three portions : above it, under it and below it.

The **Subclavian** is an active ligament.

The **Great Serrate** is noticeable for its extent.

The **Intercostals** are remarkable for the difference in the direction of the fibres in the externals and the internals.

The **Sternal Triangle** Muscle is noticeable for the difficulty to understand its use.

MUSCLES OF THE SHOULDER.

392 The **Deltoid** :

Is really the only abductor muscle of the arm.

It is supplied by one nerve only, the circumflex.

The **Supra-spinous**, the **Infra-spinous**, the **Small Round** and the **Subscapular** are really active ligaments of the Scapulo-humeral articulation.

MUSCLES OF THE ARM.

The **Coraco-brachial** :

Is the guide to the axillary and brachial arteries.

It is perforated by the Musculo-spiral nerve.

The **Biceps**—Has two heads—The long Tendinous Head runs through a joint, the only instance of the kind.—Its insertion is very limited, but very strong.—The biceps is the guide to the brachial artery.—It gives off an expansion which separates the basilic vein from the brachial artery.

The **Triceps Extensor**—Has three very distinct heads : an only instance.—The Outer and the Inner Heads are separated by the spiral groove of the humerus containing the musculo-spiral nerve.—Its insertion to the base of the olecranon process is very limited.

MUSCLES OF ANTERIOR REGION OF THE FOREARM.

393 *All the four muscles* of the superficial layer originate from the internal condyle.

The **Long Palmar** is inserted into a fascia, the palmar fascia, an only instance.

The **Ulna-Carpal Flexor** :

Presents at its origin an arch under which passes the ulnar nerve.

The tendon of insertion presents a sesamoid bone, the pisi-

form (like the patella, the flexors of the thumb and of the big toe).

It is the guide to the Ulnar Artery.

MUSCLES OF THE DEEP LAYER OF THE FOREARM.

The **Superficial Flexor** forms a layer of itself.

The **Deep Flexor** and the **Long Proper Flexor of the Thumb** form a separate layer of themselves.

All the tendons of the flexors are surrounded at the wrist by a large common synovial sac which sends a sheath to the thumb and to the little finger, but not to the other fingers.

In the fingers the tendons of the Deep flexor *perforate* those of the superficial flexors.—In the fingers the tendons have a *strong sheath* which stops at the base of the last phalanx.—The **Square Pronator** forms a layer of itself.

MUSCLES OF THE EXTERNAL REGIONS OF THE FOREARM.

The **Long Supinator** forms the outer boundary of the outer groove of the elbow.—It has a long, flat tendon.—It is the guide to the radial artery.

The **Radio-Carpal Extensors** are crossed over by the deep muscles of the posterior region.

The **Short Supinator**:

Is wrapped around the radius.

It is traversed by the radial nerve.

MUSCLES OF THE POSTERIOR REGION OF THE FOREARM.

The four muscles of the *superficial layer* originate from the external condyle.

The **Anconeus** is an active ligament.

The tendons of the extensors are joined by *transverse bands*.

The four muscles of the *deep layer* go to two fingers only, the thumb and the index; three to the thumb, the extensors of the last phalanx, of the first phalanx, of the first metacarpal bone: one to the index finger, the extensor of the index.

MUSCLES OF THE HAND.

The **Opposing** muscle of the thumb is possessed only by man and monkey.

The two heads of the **Short Flexor** of the thumb are separated by the tendon of the Long Flexor.

The **Adductor** muscle of the thumb is noticeable for its broad origin and narrow insertion.

All those muscles are inserted into two small sesamoid bones.

The **Lumbrical Muscles** are of a peculiar shape.—They originate from a tendon, the flexor, and are inserted into a tendon, the extensor.

The **Interosseous** are also peculiar in their uneven distribution to the fingers.

MUSCLES OF THE VERTEBRAL REGION.

394 The **Anterior Straight Muscles** are active ligaments.

The **Anterior Scalene** and its Tubercle is the guide to the Subclavian Artery and Vein, to the Brachial Plexus, to the Phrenic Nerve, to the Vertebral Artery, to the Pleura.

MUSCLES OF THE EXTERIOR OF THE ABDOMEN.

The **Pyramidal**:

Is the tensor muscle of the white line.

The **Abdominal Straight**: Is encased in a fibrous sheath. It presents transverse bands.

The inner borders limit the white line and are guides in laparatomies.

The Epigastric and the Internal Mammary anastomose in its substance.

The **Obliques** and the **Transverse**:

Are broad and flat.—Their fibres are differently directed in each layer.—They are continuous with those of the opposite side, through the fasciæ, passing in front and behind the straight muscle.

The **External Oblique** forms Poupart's ligament.

The **Lower Fibres** of the Internal Oblique and of the transverse form the Cremaster Muscle.

The **Posterior Border** of the two obliques form the anterior boundary of a slot, limited behind by the anterior border of the common mass of the Spinal Erector; important surgically.

MUSCLES OF THE INTERIOR OF THE ABDOMEN.

The **Diaphragm**:

Is the most perfect of all the diaphragms of the body (The others are the mylo-hyoid and the elevator of the anus.)

Its situation is remarkable and unique, in the interior of the body and dividing it into two large compartments.

It is broad, flat, curved.

Its centre is aponeurotic; it is a kind of digastric.

It presents several openings: œsophagus and inferior cava.

Its centre is attached to the pericardium.

It contracts from the centre to the periphery.

It receives a spinal nerve on each side and *no other*.

It is the *essential* muscle of respiration.

The Small Psoas:

Is sometimes wanting.

Is the tensor muscle of a fascia, like the long palmar and the tensor of the femoral fascia.

The Large Psoas:

Is the softest muscle in the body.

It contains the lumbar plexus in its substance.

It forms the lateral boundaries of the inlet of the pelvis.

It is one of only two muscles which may suppurate primarily.

It contains the crural nerve in its sheath.

The Iliac:

Is also a soft muscle.

It also may suppurate primarily.

MUSCLES OF THE INTERIOR OF THE PELVIS.

395 **The Elevator of the Anus:**

Closes the cavity of the pelvis after the manner of a small diaphragm, perforated only by the rectum.

The Pyriform:

Is covered over by the large nerves of the Sacral Plexus.

It originates in the pelvis, but terminates outside of it.

The Internal Obturator: also originates in the pelvis, but terminates outside of it.

No other muscles do this but these two.

MUSCLES OF THE ANTERIOR REGION OF THE THIGH.

The Tensor of the Femoral Fascia.

Is the largest of the tensors (the other four are the long palmar, the pyramidal of abdomen, the small psoas, the plantaris).—It is also almost entirely encased into the femoral fascia (like the abdominal straight).

The Sartorius:

Is the longest and the narrowest muscle in the body.

It crosses the thigh and the femoral vessels obliquely.

It is a most important surgical muscle.

The Quadriceps Extensor:

Is the only quadruple muscle in the body.

Its tendon is the patellar ligament.

The patella is a sesamoid bone developed in the tendon.

The deep fibres called the subcrureus are inserted into the synovial membrane.

Its arterial branches are numerous and large.

MUSCLES OF THE INTERNAL REGION OF THE THIGH.

The **Gracilis** :

Is the muscle that projects under the skin of the inner region of the thigh when the thighs are open.

It joins the Sartorius and the semi-membranous to form the goose's paw.

The **Three Adductors** :

Are the muscles of walking.

They are all triangular in shape.

They all originate from the pubis and ischium.

They are all attached to the rough line of the femur.

The great adductor presents a special long tendon.

It also forms part of Hunter's Canal.

The **Pectineus** :

Is truly also an adductor.

MUSCLES OF ANTERIOR REGION OF THE LEG.

The **Extensor of the Great Toe** :

Is covered over above by the Anterior Tibial and the Common Extensor.

Its tendon is a guide to the Dorsal Artery.

The **Third Peroneal** :

Is only a part of the Common Extensor.

MUSCLES OF THE EXTERNAL REGIONS OF THE LEG.

The **Peroneals** :

Wind around the lower part of the bone and this causes the twist in the fibula.

The musculo-cutaneous nerve winds through their upper extremity.

Are the analogue of the radio-carpal extensors.

The **Tendon of the Long Peroneal** crosses obliquely the sole of the foot and is the tensor muscle of the arch of the foot.

MUSCLES OF THE BACK OF THE FOOT.

The **Short Extensor** of the Toes :

Its tendons are inserted into the tendons of another muscle (like the lumbricals and the interosseous, the accessory flexor of the toes).

MUSCLES OF THE GLUTEAL REGION.

396 The **Great Gluteal** :

Is the thickest muscle in the body.

It forms the buttock.

| | |
|-------------------------------|---|
| The Pyriform | } Are specially the pelvic trochanterian muscles which are the active ligaments of the the Coxo-femoral articulation. |
| The Internal Obturator | |
| The External Obturator | |
| The Square Femoral | |

The **Gemellar** Muscles:

Are part of the internal obturator.

The other Gemellar Muscles of the body belong to the calf of the leg.

MUSCLES OF THE POSTERIOR REGION OF THE THIGH.

The **Biceps**:

Is the analogue of the biceps of the arm.

There are only two biceps in the body (arm and thigh).

It forms the outer upper boundary of the popliteal space.

The internal saphenous nerve is on the inside of it.

The **Semi-Tendinous**:

Forms the inner upper boundary of the popliteal space.

It contributes to form the goose's paw.

The **Semi-Membranous**:

Forms more particularly the upper inner boundary of the popliteal space.

It is the guide to the popliteal artery.

MUSCLES OF THE SUPERFICIAL POSTERIOR REGION OF THE LEG.

The **Gastrocnemii** and

The **Soleus**:

Form a triceps, the *Sural Triceps*.

The tendon is called the *Achilles Tendon*.

The **Plantaris**:

Is a peculiar little muscle.

It corresponds to the long palmar of the forearm.

It is the tensor muscle of Achilles Tendon.

MUSCLES OF THE DEEP LAYER OF THE POSTERIOR REGION OF THE LEG.

The **Popliteal**:

Is the analogue of the anconeus.

It is an active ligament.

It forms the floor of the lower part of the popliteal space.

The *other muscles* of this layer are remarkable for the change in their relative situations above and below.

The **Long Flexor of the Great Toe** in the leg is on the outside, and in the foot is on the inside.

The **Long Flexor of the Toes** is in the leg on the inside, and in the foot is on the outside.

The **Posterior Tibial** is in the leg in the middle, and *is on* the inside on the foot.

MUSCLES OF THE PLANTAR REGION.

Are similar to those of the hand.

There is no opposing muscle.

There is an additional flexor, the **Short Flexor**.

There is an **Accessory Flexor**, peculiar in that it is inserted into the tendon of the long common flexor.

It is the only muscle inserted to a tendon by fleshy fibres.

MUSCLES WHICH ARE SPECIALLY INTERESTING OR IMPORTANT.

(*Thirty-eight Muscles.*)

397 In the *Back*:—Spinal Erector —Posterior Straight and Oblique.

In the *Head*:—Occipito-frontal.—Muscles of the Face—Internal Pterygoid.

In the *Neck*:—Platysma,—Sterno-mastoid,—Digastric,—Mylo-hyoid,—Omo-hyoid.

In the *Chest*:—Great Pectoral,—Great Dorsal,—Intercostals.

In the *Shoulder*:—Deltoid,—Supra-Spinous,—Infra-Spinous,—Small Round,—Subscapular.

In the *Arm*:—Coraco-brachial,—Biceps.

In the *Forearm*:—Ulna-carpal Flexor,—Radio-carpal Flexor,—Tendons of the Flexors and their Synovial Sac,—Long Supinator,—Short Supinator.

In the *Hand*:—Opposing,—Lumbricals.

In the *Vertebral Region*:—Anterior Scalene.

In the *Abdomen*:—Diaphragm,—Psoas Iliac.

In the *Anterior Region of the Thigh*:—Sartorius,—Great Adductor.

In *Anterior and Lateral Regions of Leg*:—Proper Extensor,—Long Peroneal.

In the *Gluteal Region*:—The Pelvi-trochanterian.

In the *Posterior Region of the Thigh*:—Biceps,—Semi-membranous.

In the *Posterior Region of the Leg*:—None specially.

In the *Plantar Region*—Accessory Flexor.

MUSCLES OF SPECIAL SURGICAL IMPORTANCE.

(*Twenty-five Muscles.*)

398 In the *Head*: Masseter, on account of its action in dislocations.

In the *Neck*:—Sterno-mastoid: it is the guide to the large vessels of the neck.—Digastric: it is a special surgical region.—Mylo-hyoid: it closes the mouth below.—Omo-hyoid: it is adherent to the subclavian vein.

In the *Chest*:—Great Pectoral: it forms the anterior boundary of the axilla.—Great Dorsal: it forms the posterior boundary of the axilla.

In the *Shoulder*:—Deltoid: it is the only abductor muscle of the arm.

In the *Arm*:—Coraco-brachial: it is the guide to the axillary artery.—Biceps: it is the guide to the brachial artery.

In the *Forearm*:—Long Supinator: it is the guide to the radial artery.—Ulnar-carpal Flexor: it is the guide to the ulnar artery.—Tendon of the Flexor: on account of the synovial sac.—Short Supinator: on account of the radial nerve.

In the *Vertebral Region*: Anterior Scalene: it is the guide to many important structures.

In the *Exterior of Abdomen*:—Straight: it is the guide in laparotomies.

In the *Abdomen*:—Psoas-iliac: it is the seat of abscesses.

In the *Anterior Region of the Thigh*:—Sartorius: it is the guide to the large vessels of the region.

In the *Anterior Region of the Leg*:—Proper Extensor: it is the guide to the anterior tibial artery and the dorsal artery.

In the *External Region of the Leg*:—Long Peroneal: on account of the musculo-cutaneous nerve.

In the *Gluteal Region*:—Pyriform: it is the guide to the gluteal artery, the ischiatic artery, the pudic artery and the great sciatic nerve.

In the *Posterior Region of the Thigh*:—Biceps: it is the guide to the external popliteal nerve.—Semi-membranous: it is the guide to the popliteal artery.

In the *Posterior Region of the Leg*:—Posterior Tibial: it is the guide to the posterior tibial artery.

In the *Plantar Region*:—Muscles in relation with the course of the external plantar artery.

BLOOD.

399 **Anatomical Elements**: Are mainly the Red and the White Blood Corpuscles.

Also Blood Plates or Hematoplasts.
 Also Free Nuclei.
 Also Pigments.
 Also Crystals.
 Also Hemaglobin.

RED BLOOD CORPUSCLES.

400 **Color**: They are of an amber color when examined singly under the microscope.

Situation: In the centre of the current.

Number: 300 to one white.

Size: 0.002 to 0.003 of a line.

Shape: Biconcave disc with rounded borders, or double contour edge.—The centre is depressed and looks like a nucleus, but there is no nucleus.—When viewed in any quantity on a glass slide under the microscope they arrange themselves into pillars or columns.

Structure: They are composed of gelatinous substance. They have no nucleus.

Movements: They have no active movement of their own. They are only very elastic and extensible and alter their shape in their course through small capillaries, but soon return to their fundamental form.

WHITE BLOOD CORPUSCLES.

401 **Color**: They are white.

Situation: Along the walls of the vessel mostly.

Number: One to 300 red.

Are more numerous after eating, especially after eating animal substance.

Are more numerous in the splenic and hepatic veins.

They are scarce in the hepatic artery.

Size: They are larger than the red.

Some are large and some are small; the small ones are sometimes half the size of the large ones.

Shape: They are spherical, but may alter their shape in their course.

Structure: They are composed of protoplasm.

They show a nucleus by using acetic acid; it occupies the greater part of the corpuscle.

The larger white corpuscles usually possess two or more nuclei.

They resemble pus corpuscles.

They frequently have granular contents.

Movements: They have active movements, as explained in describing cells in general.

BLOOD PLATS OR HEMATOPLATS.

402 **Size:** They are one-third to one-half smaller than the red blood corpuscles.

Shape: They are large granules, or pale, circular or oval discs.

FREE NUCLEI.

Number: They exist in great numbers.—(Ranvier.)

BLOOD PIGMENT OR HEMATINE.

Color: Is dark brown or black.

Shape: Is a powder.

STRUCTURE OF ARTERIES.

403 **General Structure.** Arteries are formed of three coats:
1st. The *External* or *Fibrous Coat* is the most resistant.
2d. The *Middle* or *Elastic and Muscular Coat* is formed of alternate layers of elastic and muscular tissues.

The fibres pursue a longitudinal and a circular course around the vessel; the muscular fibres are of the smooth kind.

The elastic fibres are fine fibres and broad fibres, which present round or oval openings and form the so-called *Perforated* or *Fenestrated Membrane*.

3d. The *Internal* or *Serous Coat* is composed of a thin and delicate basement membrane, lined with a single layer of elongated polygonal cells.

404 **Structure in Particular, According to Size:**

1st. In *large arteries* the external fibrous coat is comparatively thin;—the middle or elastic is the thickest;—the internal is also thick.

2d. In the *middle-sized arteries* the fibrous coat is thickest.

3d. In the *smallest arteries* the middle coat consists of muscular tissue only and is the thickest;—the smaller the artery, the more abundant is the muscular tissue.

Vessels: are the *Vasa Vasorum*.—The arteries come from the small neighboring arteries and not from the trunk they supply.—The veins empty into the contiguous larger venous branches.

STRUCTURE OF VEINS.

405 They have the same general structure as the arteries, with few but important differences.

The *External Fibrous Coat* is thicker and more resistant than that of the arteries;—it gradually increases in thickness from the smallest to the largest.

The *Middle* or *Musculo-elastic Coat* is comparatively thin;—the smaller the vessel, the thinner the coat.

The *Internal* or *Serous Coat* is like that of the arteries.

It forms valves.

Venous Sinuses are venous channels which are dug in the substance of an organ and which are deprived of external and middle coats, these being replaced by the tissue of the organ itself; the interior is lined by the internal coat of veins.

Vessels of Veins: same as for arteries.

CAPILLARIES.

406 *Direct Communication exists between arteries and veins* without the intervention of capillaries, as in matrix of nails, tip of nose, fingers and toes.

The *Smallest Capillaries* are found in the nervous central system and the largest in the marrow of bones.

Serous Capillaries, i. e., vessels admitting only the serum of the blood without blood corpuscles, do not exist.

ARTERIAL CAPILLARIES

Are composed of a thin, delicate layer of smooth muscular fibres—and of a lining of longitudinal nucleated endothelial cells.

VENOUS CAPILLARIES

Have the same structure, except that the muscular fibres are much fewer.

CAPILLARIES PROPER OR INTERMEDIATE CAPILLARIES.

They are formed of a single layer of transparent elongated cells or plates with oval nuclei,—united together by thin layers of a cement substance.

They are endowed with vital contractility (Stricker).

If capillaries are abnormally distended the cement substance between the cells is liable to yield and give rise to minute holes or mouths, and thus permit blood corpuscles to pass through.

DESCRIPTION OF THE ARTERIES IN PARTICULAR.

407 **Remark.** Only the branches of some consequence in operating or in establishing collateral circulation will be considered.

Divisions. There are three different and independent circulatory circuits: the circulation of the heart, the circulation of the lungs and the general or systemic circulation.

CARDIAC CIRCULATION.

The **Arteries** are the two *Cardiac or Coronary Arteries*, which are the first branches giving off from the aorta.

Owing to the contracted condition of the heart during the ventricular systole, the blood enters these vessels during the cardiac diastole, which is the opposite with all the other arteries.

They run along the interventricular and auriculo-ventricular grooves, and anastomose freely.

The **Veins** are:

1st. The *Great Cardiac or Coronary Vein or Sinus*, which returns almost all the blood of the heart.

It runs in the anterior interventricular and the left auriculo-ventricular grooves.

And it opens into the right auricle above and to the inner side of the ascending cava.

Its orifice is guarded by an effective valve, the Valve of the Thebesius.

2d. The *Veins of Thebesius*, are small venules from the right side of the heart which open directly into the right auricle.

PULMONARY CIRCULATION.

408 It comprises the Pulmonary Circulation Proper, for the oxygenation of the blood, and the Bronchial Circulation, for the nutrition of the bronchi and the tissues of the lungs.

PULMONARY CIRCULATION PROPER.

The **Artery** is the *Pulmonary Artery*, which carries black or venous blood.

It originates from the right ventricle.

It winds around, and passes under, the first part of the aorta and divides into the right and left pulmonary arteries.

The right subdivides into three large branches, one for each lobe.

And the left into two large branches only.

Their divisions follow the bronchi and finally form a delicate plexus beneath the epithelium of the the air vesicles. The **Veins** succeed the arterial capillaries and form the Four *Pulmonary Veins*, the two right or upper veins and the two left or lower.

They also follow the bronchi and open into the left auricle of the heart.

Their orifices have no valves; they carry red blood.

BRONCHIAL CIRCULATION.

The **Arteries** are the two *Bronchial Arteries*.

They originate from the aorta.

They follow the bronchi and their divisions, but do not reach the air vesicles.

Their small size compared to the lung is easily accounted for by the small amount of solid tissue the lungs contain and the nature of that tissue, which everywhere else also possesses very few capillaries.

The **Veins** are the *Bronchial Veins*; they follow the arteries and open in the azygos.

GENERAL OR SYSTEMIC CIRCULATION—AORTA.

409 **Origin**: from the left ventricle.

Course: It describes an **Arch** which presents an ascending, a transverse, and a descending portion, and which ends on the left side of the third dorsal vertebra.

It then becomes the **Thoracic Aorta**, which gradually comes in front of the vertebræ and passes through an opening in the diaphragm opposite the first lumbar vertebra.

It is then called the **Abdominal Aorta**, and is situated almost on the middle line in front of the vertebræ, and divides opposite the fourth lumbar vertebra into the two Common Iliac arteries.

Situation or Relation.

The **Arch** is in relation:

In Front, with Left Innominate Vein and the sternum.

Behind, with the trachea.

Below, with the divisions of the pulmonary arteries, the auricles and the root of the left lung.

Above, with the branches originating from it.

On the Outside, with the Superior Cava.

On the Inside, with origin or trunk of the pulmonary artery.

The **Thoracic Aorta** is in relation with the following organs:

The *Vertebral Column*: on the left above and on the middle line below.

The *Œsophagus*: it crosses it obliquely, so that above it is on the median line, whereas the aorta is on the left; in the middle of the course the œsophagus is right over the aorta, and below the œsophagus is on the left of the median line and the aorta is on the median line.

The *Great Azygos Vein* is on the right of the aorta.

The *Thoracic Duct* is also on top of it.

The *Pleura*: on the left side only.

The **Abdominal Aorta** is in relation:

In Front, with the mesentery.

Behind, with the vertebral column.
On the Right, with the Inferior Cava.
On the Left, with the mesentery.

BRANCHES OF THE ARCH OF THE AORTA.

- 410 They are the Innominate, the Left Carotid and the left Subclavian.

INNOMINATE ARTERY.

Situation or Relations. It is in relation :

In Front, with the Left Innominate Vein, the sternum and the sterno-clavicular articulation.

Behind, with the trachea.

Externally, with the Left Superior Cava.

Internally, with the Left Common Carotid.

Branches: It gives rise occasionally only to the *Middle Thyroid*, which ascends in front of the trachea and is distributed to the thyroid body.

COMMON CAROTID.

- 411 **Origin:** The *Right* originates from the innominate, but the *Left* comes directly from the aorta.

The *Left* is therefore longer and more deeply seated.

Course: It ascends along the vertebral column to the upper border of the thyroid cartilage, where it divides.

Situation or Relations.

In Front, below it is entirely covered by the sterno-mastoid; in the *Middle* it is covered only by the edge of that muscle; above, it is not covered at all by it, but by the veins, the fascia and skin.

Behind, with the vertebral column, the pneumo-gastric and the sympathetic.

Internally, with the trachea, œsophagus, larynx and thyroid body.

Externally, with the internal jugular vein, which overlaps it considerably.

Branches: Opposite the upper border of the thyroid cartilage it divides into the External and the Internal Carotids. It gives rise to no collateral branches.

EXTERNAL CAROTID.

- 412 **Origin:** Upper border of the thyroid cartilage.

Situation and Course: It is situated at first a little to the inner side of the internal carotid,—then ascends outside of the stylo-hyoid and digastric;—it is crossed by the hypoglossal nerve;—it then penetrates the parotid gland on the inner side of the ramus of the jaw;—and opposite the tem-

poro-maxillary articulation it divides into the *Internal Maxillary* and the *Temporal*.

413 **Branches**: Are the *Superior Thyroid*, the *Lingual*, *Facial*, *Occipital*, *Internal Maxillary* and the *Temporal*.

1. The **Superior Thyroid** is distributed to the upper angle of the thyroid body.

2. The **Lingual** in a part of its course runs parallel to the great horn of the hyoid bone, one-quarter of an inch above it—it is covered by the fibres of the hyo-glossus muscle.—The hypoglossal nerve is above it and parallel to it.

3. The **Facial** crosses the posterior part of the submaxillary gland.—Strikes the face at the anterior inferior angle of the masseter.—Runs towards the commissure of the mouth.—Then in the labio-genial fold towards the wing of the nose,—and then in the naso-genial fold to the internal angle of the eye, where it is called the *Angular*.—It inosculates with the terminal branch of the ophthalmic called the *Nasal*.

It gives off the two *Labial* or *Coronary* arteries and the *Submental*.

4. The **Occipital** is situated deeply under the sterno-mastoid and trapezius, to the inner side of the mastoid process.

It supplies the occipital region.

It gives off the *Descending Cervical* (or *Princeps Cervicis*) which anastomoses with the *Posterior Ascending Cervical* (or *Profunda Cervicis*) of the *Superior Intercostal*.

5. The **Internal Maxillary** is directed from the articulation obliquely forwards and inwards,—it passes between the two heads of the internal pterygoid muscle.—It passes through the spheno-palatine foramen.—It is distributed to the nasal cavities under the name of the *Spheno-palatine* or *Nasal*.

It gives off the *Middle Meningeal*, which enters the cranium through the spinous foramen;—the *Descending Palatine* to the soft palate;—the *Inferior Dental* to the lower teeth.

6. The **Temporal** is distributed to the temporal region.

It gives off the *Transverse Facial*, which is sometimes quite large.

INTERNAL CAROTID.

414 **Origin**: Upper border of thyroid cartilage.

Course: It ascends along the vertebral column to the base of the skull.—It then passes through the Carotid Canal of the petrous bone.—It then proceeds forward through the Cavernous Sinus.—At the end of the sinus it curves backwards,—gives rise to the ophthalmic,—and divides into its terminal branches, the *Anterior* and the *Middle Cerebral Arteries*.

Situation or Relations in the Neck.

In Front, with the veins and fascia, then the stylo-hyoid and digastric, then the parotid gland.

Behind, with the vertebral column, the pneumo-gastric, sympathetic.

Internally, with the larynx, pharynx, tonsil.

Externally, with the internal jugular vein.

415 Branches: Are the *Ophthalmic, Anterior and Middle Cerebrals*.

1. The **Ophthalmic** passes into the orbit through the optic foramen, on the outer side of the optic nerve.—It crosses over the nerve to reach the inner wall of the orbit,—which it follows to the internal angle;—there it is called the *Nasal* and inosculates with the angular of the facial.

It gives off the *Lachrymal* to the lachrymal gland,—*Anterior Ciliary* to the iris,—the *Long Ciliary* to the iris,—the *Posterior Short Ciliary* to the choroid,—the *Central Artery of the Retina*.

2. The **Anterior Cerebral** is distributed to the anterior part of the great interhemispheric fissure and to the anterior lobes of the brain.

It communicates with its fellow by means of the *Anterior Communicating*.

3. The **Middle Cerebral** is distributed to the Sylvian fissure and to the middle lobe especially.

It gives off the *Posterior Communicating*, which anastomoses with the posterior cerebral from the basilar.

SUBCLAVIAN ARTERY.

416 Origin: The *Right* originates from the Innominate Artery.

The *Left* originates directly from the Aorta.

It is therefore longer and more deeply seated than the right.

Course: It arches over the pleura,—passes between the two scalenes,—and terminates at the lower border of the first rib.

Divisions: It has three portions: the first inside the scalenes, the second between the scalenes and the third outside the scalenes.

Situation and Relations:

The **First Portion, or Inside the Scalenes**, is in relation:

In Front, with the subclavian vein, the pneumo-gastric and the recurrent.

Behind, with the cervical plexus.

Above, with the Thoracic Duct, or the Right Lymphatic Duct.

Below, with the pleura.

Internally, with the common carotid.

Externally, with the border of the scalenes.

The **Second Portion, or Between the Scalenes**, is in relation:

In Front, with the anterior scalene and its tubercle, which separates it from the subclavian vein.

Behind, with the middle scalene.

Above, with the brachial flexus.

Below, with the groove of the first rib.

The **Third Portion, or Outside the Scalenes**, is in relation:

In Front, with the clavicle.

Behind, with the brachial flexus.

Below, with the first rib.

Above, with the skin, the subclavian muscle.

417 **Branches**: They all originate to the inner side of the scalene muscles.

They are: the Vertebral, the Inferior Thyroid, the Superior Intercostals, the Internal Mammary, the Anterior Scapular and the Posterior Scapular (Transverse Cervical).

Three originate from a common trunk, called the *Thyroid Axis*: the Inferior Thyroid, the Anterior Scapular and the Posterior Scapular.

1. The **Vertebral** enters the foramen of the transverse process of the sixth cervical vertebra.—It ascends through all the foramina above.—It winds around the atlas.—It enters the cranium between the occipital bone and the posterior arch of the atlas.—It joins its fellow and forms the Basilar Artery.

The Vertebral gives off the *Anterior* and *Posterior Spinal Arteries* to the oblong medulla and spinal cord,—and the *Inferior Cerebellar* to the cerebellum.

The **Basilar Artery** is situated on the middle line of the Varolian bridge—it divides into the two *Posterior Cerebrals*.

These receive the Posterior Communicating Artery from the internal carotid, thus completing the Circle of Willis, which is formed in front of the anterior cerebral and the anterior communicating from the internal carotid.

The basilar gives off also the *Middle* and *Superior Cerebellar* to the cerebellum.

2. The **Inferior Thyroid** passes behind the internal jugular vein and internal carotid artery.—It is distributed to the lower angle of the thyroid gland.

3. The **Anterior Scapular** follows the posterior border of the clavicle.—It is distributed to the supra and infra-spinous fossæ.

4. The **Posterior Scapular** or **Transverse Cervical** crosses obliquely backwards over the subclavian artery and the nerves of the brachial plexus.—It passes under the trapezius and descends along the posterior border of the scapula, under the name of *Posterior Scapular*.—At the inferior angle of the scapular it anastomoses with the subscapular artery.

5. The **Superior Intercostal** is distributed to the two or three superior intercostal spaces.

It gives off the *Posterior Ascending* or *Deep Cervical*, which anastomoses with the descending cervical of the occipital.

6. The **Internal Mammary** descends behind the intercostal cartilages, one-quarter of an inch to the outer side of the sternum.

It penetrates the abdominal straight muscle, being called the *Descending Epigastric*.

It terminates by inosculating with the deep ascending epigastric from the external iliac.

AXILLARY ARTERY.

418 **Origin:** Lower border of the first rib.

Course: It begins at the lower border of the first rib, below the subclavian and clavicle.—It traverses the axillary space in its axis.—It terminates at the lower border of the tendons of the great pectoral and great dorsal muscles, where it becomes the brachial.

Situation or Relations: It is in relation:

In Front, with the vein, the nerves and the fascia.

Behind, with the joint and the humerus.

Above, with the coraco-brachial, which is the guide to it.

Below, with the long head of the triceps and the tendon of the great dorsal.

419 **Branches:** Are the Long Thoracic, the Subscapular and the Posterior Circumflex.

1. The **Long Thoracic** runs between the small pectoral and the great serrate, to which it is mostly distributed.

2. The **Subscapular** is a very large and important branch. It anastomoses freely with the perforating branches of the intercostals and the scapulars.

3. The **Posterior Circumflex** is large. It winds around the posterior part of the surgical neck of the humerus;—it anastomoses with the scapulars and the deep brachial.

BRACHIAL ARTERY.

420 **Origin:** Lower border of the tendon of the great pectoral.

Course: It descends vertically to below the articular line of the elbow in front of the insertion of the biceps.—It divides therein to the Radial and the Ulnar.

Situation or Relations: Its relations vary above the elbow and at the elbow.

Above the Elbow, it is in relation:

Internally, with the median nerve, which crosses it obliquely, the fascia, the skin.

Externally, with the anterior brachial.

Anteriorly, with the border of the biceps, which is a guide to it.

Posteriorly, with the humerus.

At the Bend of the Elbow :

It occupies the inner groove.

It is in relation :

In Front, with the Median Vein, the Expansion of the biceps and the Two Brachial Veins.

Behind, with the Anterior Brachial.

Externally with the Tendon of the Biceps.

Internally, with the Median Nerve and the Round Pronator.

421 **Branches** : are the Superior and Inferior Deep Brachial and the Great Anastomotie.

1. The **Superior Deep Brachial** runs in the spiral groove, together with the musculo-spiral nerve, and anastomoses with the recurrents.

2. The **Inferior Deep** anastomoses with the ulnar recurrent arteries.

3. The **Great Anastomotie** does the same.

RADIAL ARTERY.

422 **Origin** : From the bifurcation of the brachial, below the bend of the elbow.

Situation and Course : It follows the radius and the long supinator muscle, which is the guide to it ;—it winds around the outer part of the wrist, under the extensor tendons of the thumb ;—it passes through the first interosseous space ;—it enters the palm of the hand, where it becomes the Deep Palmar Arch.

Branches. It gives off :

1st. The **Recurrent Radial Artery**, which anastomoses with the deep brachial.

2d. The **Superficial Palmar or Volar** to the Superficial Palmar Arch.

3d. The **Carpals**.

4th. **Metacarpals**.

5th. **Dorsal and Palmar Arteries** of the thumb and index fingers.

6th. The **Deep Palmar Arch**, which is situated behind all the tendons, resting upon the upper part of the metacarpal bones.

The **Arch** is completed by a deep branch from the ulnar.—It gives off the **Interosseous** and **Collateral** arteries of the fingers.

ULNAR ARTERY.

423 **Origin** : From the bifurcation of the brachial, below the bend of the elbow.

Situation and Course: It passes under the round pronator and superficial flexor;—it follows the ulno-carpal flexor, which is the guide to it, to the pisiform bone;—there it crosses the palm of the hand *in front* of the flexor tendons;—it forms the Superficial Palmar Arch.

424 **Branches.** It gives off:

- 1st. The **Anterior Ulnar Recurrent**.
2. The **Posterior Ulnar Recurrent**, which anastomoses with the inferior deep brachial and the great anastomotie.
- 3d. The **Anterior Interosseous**.
- 4th. The **Posterior Interosseous**, which gives off the **Interosseous Recurrent**, which anastomoses like the others.
- 5th. The **Anterior and Posterior Carpal** arteries.
- 6th. The **Deep Communicating Artery** to the Deep Palmar Arch.
- 7th. The **Superficial Palmar Arch**, which gives off the *Digitals* which join the interosseous to form the *Collaterals of the Fingers*.

BRANCHES OF THE THORACIC AORTA.

- 425 It gives off: 1st, the *Bronchial* to the bronchi;—2d, the *Intercostals*, to the nine lower intercostal spaces;—these give off the *Lateral Perforating Branches*, which anastomose with the Subscapular (axillary).

BRANCHES OF THE ABDOMINAL AORTA.

- 426 They are:—1st, the **Cœliac Axis**: It originates on a line with the upper border of the neck of the pancreas;—it divides into the *Gastric*, distributed along the smaller curvature of the stomach;—the *Hepatic*, which enters the liver through the transverse fissure;—the *Splenic*, which runs along the upper border of the pancreas and ends in the spleen.
- 2d. The **Superior Mesenteric**. It originates along the inferior border of the neck of the pancreas.
It is distributed to all the small intestines and to the right half only of the large intestines.
- 3d. The **Inferior Mesenteric**. It originates lower down—it is distributed to the left half only of the large intestines;—on the rectum it divides into the two *Superior Hemorrhoidal* arteries, which extend as low down as the anus.
- 4th. The **Supra-renals**. They are distributed to the supra-renal capsules.
- 5th. The **Renals**. They are very large;—the right is the lower;—they are situated behind the vein and in front of the pelvis of the ureter.
- 6th. The **Two Spermatic**. They originate below the renal;—they descend along the psoas muscle;—they run through

the inguinal canal;—they descend into the scrotum;—they are distributed to the epididymis and testicles.

7th. The **Two Phrenic**. They are distributed to the diaphragm.

8th. The **Lumbar**s. They are distributed between the psoas and square lumbar muscles.

9th. The **Middle Sacral**. It descends along the middle line of the sacrum.

COMMON ILIAC.

427 **Origin**: From the bifurcation of the aorta at the fourth lumbar vertebra.

Course: It runs along the psoas muscle to the sacro-iliac junction.—Here it divides into the Internal and External Iliacs.

Situation or Relations:

In Front, it is covered by the peritoneum and ureter.

Behind, it rests on the psoas.

Internally, with the vein.

Branches: None.

INTERNAL ILIAC.

428 **Origin**: From the bifurcation of the common iliac opposite the sacro-iliac articulation.

Course: It descends toward the upper part of the great sacro-sciatic notch.—There it divides into visceral branches, parietal intra-pelvic branches and parietal extra-pelvic branches.

Situation or Relations:

In Front, with the peritoneum and the ureter.

Behind, with the sacro-iliac junction.

Internally, with the vein.

429 The **Visceral Branches** are:

The **Three Vesicals**.

The **Uterine**, a very large branch, penetrating at the neck.

The **Vaginal**.

The **Parietal Intra-Pelvic Branches** are:

The **Ilio-Lumbar**, situated at the upper part of the articulation.—It anastomoses with the lumbar (aorta).

The **Obturator**, running forward along the brim of the pelvis and then through the obturator canal.—It anastomoses with the circumflex (femoral).

The **Lateral Sacral**, anastomosing with the middle sacral (aorta).

The **Parietal Extra-Pelvic Branches** are:

The **Gluteal**: It passes out through the upper part of the great sacro-sciatic notch above the pyriform muscle.

It is distributed between the two layers formed by the three gluteal muscles.

The **Ischiatic**: It passes out through the lower part of the great sacro-sciatic notch below the border of the pyriform muscle, in company with the internal pudic and the sciatic nerve.

It is distributed to the muscles of the upper back part of the thigh.

It anastomoses with the Deep Femoral.

The **Internal Pudic**: It passes out of the pelvis through the lower part of the great sciatic notch.—It winds around the spine of the ischium to penetrate into the small sacro-sciatic notch.—It runs along the ascending branch of the ischium.

Upon reaching the root of the penis it terminates on the back of the penis as the Dorsal Artery.

Branches: It gives rise to the following:

The *Bulbous*, to the bulb, important because of its size.

The *Cavernous*, to the Cavernous Bodies.

EXTERNAL ILIAC.

430 **Origin**: From the bifurcation of the common iliac, opposite the sacro-iliac articulation.

Course: It extends from the sacro-iliac junction to Poupart's ligament.—There it becomes the femoral.

Relations: It is situated to the outer side of the border of the *psoas* muscle.—It is covered by the peritoneum;—it is crossed by the spermatic duct;—it is on the outer side of the vein.

431 **Branches**: They are the Circumflex Iliac and the Epigastric.
1st. The **Circumflex Iliac** runs along the iliac crest and Poupart's ligament.

It is distributed to the *psoas* and the abdominal muscles.

2d. The **Epigastric** (deep or ascending) runs along the inner side of the internal abdominal ring towards the border of the abdominal straight.

It penetrates the muscle and anastomoses with the internal mammary.

FEMORAL.

432 **Origin**: From the external iliac, at Poupart's ligament.

Course: It extends from Poupart's ligament to the opening in the great adductor muscle.—There it becomes the popliteal.

Situation or Relations:

Above, it occupies the middle of Scarpa's triangle;—it lies to the inner side of the sartorius, the *psoas*-iliac and anterior crural nerve;—it is on the outer side of the vein.

In the middle of the thigh it is covered by the sartorius,—is on the inner side of the internal vast muscle,—in front of the vein.

Below the middle it lies in Hunter's canal,—on the inner side of the vastus internus,—on the outer side of the sartorius,—in front of the vein.

- 433 **Branches:** They are the Deep Femoral, Anterior Circumflex and Great Anastomotie.

1st. The **Deep Femoral** is really a bifurcation of the femoral.

It originates about one inch below Poupart's ligament.

It is situated on the *outer side* of the femoral, between it and the psoas-iliac tendon.

It runs down in the groove between the adductors and the internal vast muscle.

It gives off *Perforating Branches*, which go to the posterior part of the thigh and anastomose with the ischiatic.

2d. The **Anterior Circumflex** often arises from the deep femoral.

It winds around the posterior part of the neck of the femur.

It anastomoses with the obturator and the ischiatic.

3d. The **Great Anastomotie** originates above the ring of the great adductor.

It descends along the tendon of this muscle.

It anastomoses with the articulares from the popliteal.

POPLITEAL.

- 434 **Origin:** From the femoral, at the ring of the first adductor.

Course: It extends from the opening of the great adductor to the arch of the soleus, where it divides into the Anterior and Posterior Tibials.

Situation or Relations:

Above the joint, it lies on the femur—to the outer side of the tendon of semi-membranous,—to the inner side of the vein and the popliteal nerve,—the latter being itself to the outer side of the vein.

Opposite the joint, it rests on the posterior ligament,—is covered by the vein,—which is itself covered by the nerve. *Below the joint*, it rests upon the popliteal muscle and the tibia,—is on the outer side of the nerve and the vein, but considerably overlapped by the vein.

- 435 **Branches:** They are the Articular Arteries.

1. The **Superior External** and **Internal Articulars**.

2. The **Inferior External** and **Internal Articulars**, which are distributed to the interior of the joint.

They anastomose with the great anastomotie of the femoral.

3d. The **Middle** or **Azygos Articular** is distributed to the interior of the joint.

ANTERIOR TIBIAL.

- 436 **Origin:** From the popliteal, at the arch of the soleus.
Situation and Course: It pierces the upper part of the interosseous membrane.—It descends between the anterior tibial muscle and the long extensor of the great toe to the anterior tarsal ligament.—There it becomes the Dorsal of the Foot.
Branches: The *Recurrent Tibial*, which ascends on the outer side of the front of the knee.
 It anastomoses with the articulares and great anastomotie.

DORSAL ARTERY OF THE FOOT.

- 437 **Origin:** From the anterior tibial, at the anterior tarsal ligament.
Situation and Course: It extends from the anterior tarsal ligament to the posterior extremity of the first interosseous space.—There it becomes the *Perforating or Communicating*, which inosculates with the internal plantar artery.
 It is situated on the tarsal bones.—It is covered by the skin.—Is on the outer side of the tendon of the extensor of the great toe.
Branches: They supply the tarsus, metatarsus and the great toe.

POSTERIOR TIBIAL.

- 438 **Origin:** From the popliteal, at the arch of the soleus.
Situation and Course: It extends from the arch of the soleus to the internal tarsal ligament, where it divides into the internal and external plantar.
 It descends on the middle line to the groove between the posterior tibial muscle and long flexor of the toes;—lower down it inclines to the inner side of the ankle,—there it is situated between the tendons of the long flexor of the toes and the long flexor of the great toe, and is covered by the skin and fascia.
 The *Posterior Tibial Nerve* above is on the inner side;—in the middle it crosses the nerve,—and below it is on its outer side.
Branches: Only one, the *Peroneal*, which descends along the fibula and divides into an Anterior and a Posterior Peroneals.

EXTERNAL PLANTAR.

- 439 **Origin:** From the posterior tibial, at the internal tarsal ligament.
Situation and Course: It is the continuation of the posterior tibial.—It extends from the internal annular liga-

ment to the posterior extremity of the first interosseous space.—It inosculates with the dorsal of foot.

It is at first directed outwards and forwards between the short flexor of the toes and the accessory muscle to reach the fifth metatarsal bone.—There it turns towards the posterior extremity of the first interosseous space, forming the plantar arch, which rests on the posterior extremity of the metatarsal bones.

Branches: The *Plantar Arch*, which supplies the four outer toes.

INTERNAL PLANTAR.

440 **Origin:** From the posterior tibial, at the internal tarsal ligament.

Branches: Are lost in the muscles of the internal region of the foot.

PECULIARITIES OF ARTERIES IN PARTICULAR.

441 **Large Arteries** are superficial at one end and deep at the other.

The **Innominate Artery:**

Is crossed at right angle by the left Innominate vein.

It is short and large,—it is the shortest of all large arteries.

It seldom gives rise to collateral branches.

The **Common Carotid:**

It is crossed by the sterno-mastoid.

It gives rise to no branches.

The **External Carotid:**

Is crossed by the hypoglossal nerve.

The **Lingual** runs parallel to the hyoid bone and to the hypoglossal nerve.

The **Occipital** gives rise to the Descending Cervical (a surgical collateral branch).

The **Internal Carotid:**

Runs through a long channel, the carotidean canal.

It runs also through a sinus, the cavernous sinus.

It forms the anterior segment of the circle of Willis, a surgical collateral branch.

It gives rise to no branches in the neck, nor in the canal nor in the sinus.

The **Subclavian:**

Is crossed by the phrenic nerve, the pneumo-gastric, the recurrent laryngeal, the thoracic duct on the left and by the right lymphatic duct on the right.

The **Left Subclavian** is longer and situated more deeply than the right.

The tubercle of the anterior scalene is the guide to the subclavian artery.

It gives rise to the Vertebral and to the Superior Inter-costal, which itself gives rise to the Ascending Cervical, a surgical collateral branch.

It presents the thyroid axis; *i. e.*, one short branch giving rise to three arteries.

All its branches originate from the first portion.

It gives rise to no branches in the middle and third portions.

The Vertebral :

Ascends through an interrupted bony canal.

It winds around the lateral mass of the atlas.

The Right and the Left unite to form the Basilar.

The Branches of the Basilar form the posterior segment of the circle of Willis.

The Internal Mammary :

Anastomoses with the Epigastric, and it is the only direct anastomose between the supra and the infra-diaphragmatic circulations.

The **Posterior Cervical** (or Cervical Transverse) crosses the Subclavian artery and the branches of the brachial plexus.

442 The Axillary Artery :

It is pronged by the median nerve.

It gives rise to the subscapular, a large surgical collateral branch.

The Brachial :

Is crossed obliquely by the median nerve, which is usually on top of it.

It gives rise to the Superior Profunda, an important surgical collateral branch.

The **Radial** gives rise to the Recurrent Radial, the Volar and the Deep Palmar Branch, all important collateral surgical branches.

The **Ulnar** gives rise to the Recurrent Ulnar, the Interosseous, the branch of the Superficial Palmar Arch, all important surgical collateral branches.

443 The Arch of the Aorta :

It is the only arch of the kind except azygos vein and thoracic duct.

It is crossed obliquely by the Innominate Vein.

It is wound around by the Pulmonary Artery.

It is also wound around by the Left Recurrent Laryngeal Nerve.

The **Thoracic Aorta** is crossed obliquely by the œsophagus.

The **Abdominal Aorta** and Branches will be studied with the arteries of the organs.

The **Common Iliac** gives rise to no branches.

The Internal Iliac :

Is crossed by the ureter at its origin.

It gives rise to the Ischiatic, a most important surgical collateral branch.

The External Iliac :

Gives rise to no branches until near its termination.

Then it gives rise to the Epigastric, an important surgical collateral branch.

It is crossed by the ureter and the spermatic duct.

The Femoral :

Is crossed obliquely by the Sartorius.

A portion is contained in a fibrous canal,— Hunter's Canal.

It gives rise to the Profunda and the Great Anastomotic, two important surgical collateral branches.

The Popliteal :

Is deeply seated.

It is crossed obliquely by the vein and the nerve.

It gives rise to the articulares, important surgical collateral branches.

The Anterior Tibial :

Gives rise to the Recurrent Tibial, a surgical collateral branch.

It gives rise also to the Dorsal, which inosculates with the External Plantar.

The **Posterior Tibial** gives rise to the Peroneal, a surgical collateral branch.

It gives rise also to the External Plantar, which forms the Plantar Arch and inosculates with the Dorsal.

PECULIARITIES OF THE ARTERIES OF THE ORGANS.

ORGANS OF DIGESTION.

444 Lips :

The Coronary Arteries reach the lips at the commissure.

They are between the muscular and mucous layers in the glandular layer.

Teeth :

The Inferior Dental Artery runs through a bony canal.

Tongue :

The Ranine arteries are dangerously large beyond the anterior half.

Tonsils :

The Tonsillar branch is large, and is adherent to the tissue in chronic tonsillitis ; hence hemorrhage.

The Internal Carotid is close to its external surface.

Parotid Gland :

The External Carotid divides in its substance behind the condyle.

Submaxillary Gland:

The facial artery crosses its posterior extremity.

Pharynx:

The Internal Carotid is in relation with the lateral walls.

Œsophagus:

It is crossed obliquely by the aorta.

Stomach:

It is surrounded by an arterial circle.

Small Intestines:

They are supplied by one artery alone, the Superior Mesenteric.

Large Intestines:

The right half is supplied by the Superior Mesenteric.

The left half by the Inferior Mesenteric, which terminates by the Superior Hemorrhoidal to the rectum.

Rectum:

Is supplied by the *Three* Hemorrhoidals.

The Superior Hemorrhoidals are the largest and most dangerous.

Anus:

Is supplied by the Inferior Hemorrhoidals, which are small.

Liver:

The Hepatic Artery is remarkable for its small size.

Spleen:

The Splenic Artery is remarkable for its large size.

ORGANS OF URINATION.

445 **Kidneys:** The Renal Arteries are remarkable for their large size.

The right is lower than the left.

They are in front of the calices and pelvis, and behind the veins.

They form a Capillary Arterial Portal System.

They carry darker blood than the veins.

Bladder:

It is well provided with arteries; three branches on each side.

ORGANS OF GENERATION.

Testicles:

The Spermatic Arteries are long and slender.

Spermatic Duct:

The Spermatic Artery is closely attached to it.

Penis:

It has two Dorsal Arteries.

They terminate by dilated extremities.

THE HEART.

446 *Has Two Coronary Arteries.*

They originate below the Sigmoid valves.

They fill up during ventricular diastole and by arterial systole.

ORGANS OF RESPIRATION.

Lungs :

The *Bronchial Arteries* :

Are remarkably small.

They are the nutrient arteries.

The *Pulmonary Artery* :

Is remarkably large for the organs.

It contains dark blood.

It terminates by three capillary plexuses.

Thyroid Body :

It is remarkably vascular for its size.

It has five Thyroid Arteries.

CENTRAL ORGANS OF INNERVATION.

Cerebral Dura Mater :

It presents the Middle Meningeal Artery.

Cerebral Pia Mater :

It is remarkably vascular.

Cerebrum :

The arteries form the circle of Willis.

No large arteries penetrate its substance.

Cerebellum :

It is not as well supplied with arteries as the cerebrum.

Spinal Cord :

It presents the two long anterior and posterior Spinal Arteries.

ORGANS OF SPECIAL SENSE.

447 **Choroid :**

It is provided with numerous arteries.

Retina :

It presents the Central Artery of the Retina, which is unique in its course in the optic nerve.

The terminal divisions of this artery are remarkable.

Iris :

It is remarkably vascular.

It receives the arteries from two sources: the Posterior Long Ciliary and the Anterior Short Ciliaries.

ORGANS OF HEARING.

Nothing special.

ORGANS OF LOCOMOTION.

Bones :

The Long Bones specially possess a Nutrient Artery.

The Petrous Bone is traversed by the Internal Carotid.

The Inferior Maxilla is traversed by the Inferior Dental Artery.

Articulations :

Many of these are surrounded by Arterial Articular Circles.

Muscles :

The Internal Pterygoid is traversed by the Internal Maxillary.

ORGANS OF CIRCULATION.

Arteries :

The Arteries of Arteries come from neighboring branches and from the trunk itself.

Veins :

Arteries of Veins come from neighboring branches.

LINES INDICATING THE DIRECTION OF THE MAIN ARTERIES AND MUSCLES WHICH ARE GUIDES TO ARTERIES.

- 448 1st. **Innominate.** Line from the middle of the sternal junction to the sternal tendon of the sterno-mastoid.
- 2d. **Common, External and Internal Carotids.** Line from sterno-clavicular articulation to space between mastoid process and angle of lower jaw. *Guide:* the sterno-cleido-mastoid muscle.
- Bifurcation of Common Carotid.** Opposite upper border of thyroid cartilage.
- 3d. **Lingual.** Line parallel to great horn of hyoid bone, one-third inch above it. *Guide:* hyoglossus muscle and hypoglossal nerve.
- 4th. **Facial.** 1st. Line from great horn of thyroid cartilage to anterior inferior angle of masseter.—2d. Line from anterior inferior angle of masseter to angle of lip.—3d. Line from angle of lip to groove of wing of nose.—4th. Line from groove of nose to angle of eye.
- 5th. **Internal Maxillary.** Immediately behind the condyle of the jaw.
- 449 6th. **Subclavian Artery.** Line corresponding to the middle of space between posterior border of sterno-mastoid and anterior border of trapezius. *Guide:* anterior scalene and its tubercle on the first rib.
- 7th. **Axillary (1st portion) Infra-clavicular region.** Line below anterior convexity of clavicle. *Guide:* small pectoral and the axillary vein.

- 8th. **Axillary in Axillary Space.** Line from apex of *axilla* to middle of space between tendons of great pectoral and great dorsal. *Guide:* coraco-brachial and the two heads of the median nerve.
- 9th. **Subscapular Artery.** Inner part and lower end of glenoid cavity. *Guide:* tendon of the great dorsal.
- 10th. **Brachial.** Line from pit of axilla to middle of bend of elbow. *Guide:* above, coraco-brachial; in middle, biceps and median nerve; below, tendon of biceps and median nerve.
- 11th. **Radial in Forearm.** Line from middle of bend of elbow to styloid process. *Guide:* the long supinator.
- 450 12th. **Radial Along Outer Border of Wrist.** Line from tubercle of supinator to upper extremity of first interosseous space. *Guide:* tendons of extensors of metacarpal bone and phalanges of thumb, which it crosses diagonally.
- 13th. **Ulnar.** Line from middle of bend of elbow to inner side of pisiform bone. *Guide:* ulno-carpal flexor.
- 14th. **Superficial Palmar Arch.** Line of the thumb separated widely from the fingers.
- 15th. **Deep Palmar Arch.** Same line, but half an inch nearer the wrist.
- 451 16th. **Internal Mammary.** About one-quarter inch to outer side of border of sternum.
- 17th. **Epigastric.** Line from middle of Poupart's ligament to umbilicus.
- 18th. **Common and External Iliac.** Line from right of middle of Poupart's ligament to two inches below the umbilicus. *Guide:* psoas muscle.
- 19th. **Gluteal Artery** (point of emergence at buttock). Junction of middle with inner third of a line from the posterior superior spine of ilium to great trochanter rotated inward.
- 452 20th. **Internal Pudic.** Junction of lower and middle third of a line from outer side of tuberosity of ischium to posterior superior spine of pubis.
- 21st. **Ischiatic.** Same place, but nearer the middle of the line.
- 22d. **Bulbous Artery** (from *Internal Pudic*). Horizontal line midway between anus and root of scrotum.
- 23d. **Femoral Artery.** Line from middle of Poupart's ligament to tubercle of great adductor (upper two-thirds). *Guide:* sartorius muscle.
- 453 24th. **Popliteal.** Line, axis or middle of the hams of the space. *Guide:* semi-membranous muscle, the vein and the nerve.
- 25th. **Anterior Tibial.** Line from head of fibula to middle of intermalleolar space. *Guide:* anterior tibial muscle.
- 26th. **Dorsal Artery.** Line from middle of intermalleolar

space to first interosseous space. *Guide:* tendon of long extensor of great toe (artery on outer side).

27th. **Posterior Tibial.** Line from middle of popliteal space to middle of space between internal malleolus and calcaneum. *Guide:* tendon of the posterior tibial muscle.

28th. **Peroneal Artery.** Line from middle of popliteal space to posterior border of external malleolus. *Guide:* long flexor of great toe.

29th. **Plantar Arch.** Line from posterior extremity of fifth metatarsal bone to posterior extremity of first metatarsal.

CIRCULATORY CIRCUITS.

- 454 There are three different and independent circulatory circuits: the Cardiac, the Pulmonary and the General or Systemic.

The **Cardiac Circuit** corresponds to the two Cardiac Arteries, to the Great Cardiac Vein and to the Veins of Thebesius.

The **Pulmonary Circuit** comprises the Bronchial Circulation and the Pulmonary Circulation.

The **Bronchial Circuit** corresponds to the Two Bronchial Arteries and to the Bronchial Veins.

The **Pulmonary Circuit Proper**, corresponds to the Pulmonary Artery and to the Four Pulmonary Veins.

The **General or Systemic Circuit** comprises the Supra-Diaphragmatic and the Infra-Diaphragmatic circulations.

These Two Circuits communicate together through the anastomose of the Internal Mammary with the Epigastric in front, and behind by the anastomose of the Lower Intercostals with the Lumbar Arteries. The Venous communications are through the veins accompanying the arteries and, through the anastomoses of the origin of the azygos with the lumbar veins.

The **Supra-Diaphragmatic Circuit** corresponds to the Arch and its Branches and to the Superior Cava Vein and its Branches.

It presents a Cephalic and a Brachial Circuit.

The **Cephalic Circuit** corresponds to the Branches of the Carotids and the Jugular Veins.

The Cephalic Circuit is subdivided into the Exterior and the Interior Circuits.

The **Exterior Circuit** corresponds to the External Carotid, the Facial and Temporal Arteries, and to the External Jugular Vein.

The **Interior Circuit** corresponds to the Internal Carotid and to the Internal Jugular Vein.

The **Brachial Circuit** or Circuit of the Upper Extremity corresponds to the Subclavian, Axillary, Brachial, Radial

Ulnar Arteries and to the Veins of the same name joining into the Innominate Vein.

- 455 The **Infra-Diaphragmatic Circuit** corresponds to the Thoracic and Abdominal Aorta, and to the Inferior Cava Vein.

It comprises the following peculiar circuits:

The *Portal-Hepatic Circuit*, which corresponds to the Cœliac Axis of the Two Mesenteric arteries and to the Formative Branches of the Portal Vein and to the Hepatic Veins.

The *Renal Circuit* is formed by the Renal Arteries and Veins.—It presents the peculiar *Arterial Portal System* of the Malpighian Corpuscles.

The *Penile Circuit* corresponds to the Two Dorsal Arteries and to the Single Dorsal Vein.

The *Circuits in the Pregnant Uterus* present three divisions.—The *Circulation of the Uterine Walls* corresponds to the Ovarian and Uterine Arteries and their Veins.—The *Circulation of the Embryo* or of the Umbilical Vesicle and — The *Circulation of the Fœtus* or Placental Circulation, presents the peculiar Venous Hepatic Branch, the Oval Foramen and the Arterial Aortic Duct.

The **Circuit of the Pelvis** corresponds to the Internal Iliac and its Veins.

The **Circuit of the Lower Extremity** corresponds to the Iliacs and Divisions and of their Veins.

ARTICULAR ARTERIAL CIRCLES.

- 456 *Each large articulation* is surrounded by a circle of arteries which are the collateral channels by which the circulation is re-established when the main trunks are ligated. Thus:

Neck and Trunk. Anastomoses of:

Superior Thyroid with *Inferior Thyroid*.

Occipital and its *Descending Cervical Branch* with the *Superior Intercostal* and its *Ascending Cervical Branch*.

The *Vertebral* with the *Internal Carotid* through the circle of Willis.

The *Nasal of Ophthalmic* with the *Nasal of the facial*.

Arm and Trunk. Anastomoses of:

Scapulars of *Subclavian* with *Subscapular* and *Circumflex* of the *Axillary* and *Ascending of Profunda* of *Brachial*.

Subscapular, *Long Thoracic*, *Circumflex*, *Deep Brachial* and *Scapulars* of *Subclavian* with *Perforating Aortic Intercostals*.

Elbow: Anastomoses between the two *Profundæ* and the Anastomotie of the *Brachial* with the *Recurrent Radial*, *Recurrent Ulnar*, *Recurrent Interosseous*.

Wrist and Hand:

Anastomoses through the *Palmar Arches*.

Anastomoses of the *Interosseous* and the *Carpals*.

Anastomose between the Supra-diaphragmatic and the Infra-diaphragmatic Arteries through the anastomoses of:

Internal Mammary and Epigastric.

Intercostals and Epigastric.

Lumbar Arteries with the last Intercostals.

Trunk and Thigh. Anastomoses of:

Ischiatic with *Profunda*.

Circumflex Iliac with the Lumbar Arteries.

Circumflex and *Obturator* with Epigastric and Internal Mammary.

Knee Joint. Anastomoses of:

The four *Articulars* with the great Anastomotic and with Recurrent Tibial.

Ankle and Foot. Anastomoses of the—

Dorsal with the External Plantar.

Dorsal with the Peroneal.

Anterior Tibial with the Peroneal.

ENUMERATION OF THE MOST IMPORTANT BRANCHES OF ARTERIES NECESSARY TO UNDERSTAND THE ESTABLISHMENT OF THE COLLATERAL CIRCULATION AFTER THE LIGATURE OF ARTERIES.

457 **External Carotid**:—Superior Thyroid,—Lingual,—Facial,—Occipital, giving rise to Descending Cervical,—Internal Maxillary,—Temporal.

Internal Carotid:

Nasal, the terminal branch of the Ophthalmic.

Anterior Cerebral, giving rise to the Anterior Communicating.

Middle Cerebral, giving rise to the Posterior Communicating.

Subclavian Artery:

Vertebral, forming the Basilar, which divides into the Posterior Cerebrals.

Inferior Thyroid.

Superior Intercostal, giving rise to the Ascending Cervical.

Internal Mammary.

Anterior Scapular (or Supra-scapular).

Posterior Scapular (or Transverse Cervical).

Axillary:—Long Thoracic,—Subscapular,—Posterior Circumflex.

Brachial:—Superior Deep Brachial,—Inferior Deep Brachial,—Great Anastomotic.

Radial:—Recurrent Radial,—Palmar or Volar,—Carpals,—Metacarpals,—Deep Palmar Arch.

Ulnar:—Anterior Ulnar,—Posterior Ulnar,—Anterior Interosseous,—Posterior Interosseous,—Recurrent Interosseous,—Carpals,—Metacarpals,—Branch to Deep Palmar Arch,—Superficial Palmar Arch.

- 458 **Thoracic Aorta** :—Intercostals.
Abdominal Aorta :—Lumbar.
Internal Iliac.
Visceral Branches :—Vesical,—Uterine,—Vaginal.
Parietal Intra-pelvic :—Ilio-lumbar,—Lateral Sacral,—Obturator.
Parietal Extra-pelvic :—Gluteal,—Ischiatic,—Internal Pudic.
External Iliac :—Epigastric,—Circumflex Iliac.
Femoral :—Deep Femoral, giving rise to Perforating,—Anterior Circumflex,—Great Anastomotic.
Popliteal :—Superior Articulars, Internal and External.—Middle Articulars,—Inferior Articulars, Internal and External.
Anterior Tibial :—Recurrent Tibial.
Dorsal of the Foot, terminating into the Perforating and Communicating.
Posterior Tibial :
 Peroneal, giving rise to Anterior and Posterior Peroneals.
External Plantar forming the Plantar Arch, inosculating with the Perforating.

SURGICAL COLLATERAL BRANCH OF THE MAIN ARTERIES.

- 459 *It is the branch which is commonly the great anastomotic medium by which the blood is carried to the parts beyond the ligated trunk.*
In some situations we find also a smaller accessory collateral surgical branch.
 The **Common Carotid and the Internal Carotid** form really but one artery, and its surgical collateral branch is the **External Carotid**.
 The Surgical Collateral branch of the **External Carotid** is the **Occipital Artery**, on account of its **Descending Cervical branch** which anastomoses with the **Ascending Cervical branch** of the **Superior Intercostal** from the **Subclavian**.
 The Surgical Collateral Branches of the **Internal Carotid** are the **Anterior and Posterior Communicating** of the circle of **Willis**.
 The Surgical Collateral Branch of the **Subclavian** is the **Vertebral**, because of its free anastomoses with the circle of **Willis**.
 The **Accessory Branch** is the **Ascending Cervical** from the **Superior Intercostal**, on account of its anastomoses with the **Descending Cervical** from the **Occipital** of the **External Carotid**.
 The Surgical Collateral Branch of the **Axillary** is the **Subscapular**.—The **Accessory Branch** is the **Posterior Circumflex**.

The Surgical Collateral Branch of the **Brachial** is the Superior Deep Brachial.—The *Accessory Branch* is the Great Anastomotic.

The Surgical Collateral Branch of the **Radial** is the Recurrent Radial.—The *Accessory Branches* are the Volar and the Superficial Palmar Arch.

The Surgical Collateral Branches of the **Ulnar** are the Interosseous, Anterior and Posterior, because of the anastomoses through the Recurrent Ulnar with the Deep Brachial and below with the Carpal Arteries from the Radial and Ulnar.

The *Accessory Branch* of the Ulnar is the Deep anastomotic branch to the Deep Palmar Arch.

- 460 The Surgical Collateral Branches of the **Thoracic Aorta** are the Intercostal Arteries, because of the anastomoses with the Subscapular.

The Surgical Collateral Branches of the **Abdominal Aorta** are the Lumbar, which anastomose with the Ilio-lumbar.

The **Common and the External Iliacs** form really but one artery, and the Surgical Collateral Branch is the Internal Iliac.—The *Accessory Branch* is the Ischiatic.

The Surgical Collateral Branch of the **External Iliac** is the Epigastric.—The *Accessory Branch* is the Circumflex Iliac.

The Surgical Collateral Branch of the **Femoral** is the Deep Femoral, on account of its anastomoses above with the Ischiatic from the Internal Iliac and below with the Articulars from the Popliteal.—It is the typical surgical collateral branch.—The *Accessory Branch* is the Great Anastomotic.

The Surgical Collateral Branch of the **Popliteal** is the Anterior Tibial, because it anastomoses above with the Articulars and Great Anastomotic and below through the Perforating Artery with the External Plantar, Posterior Tibial and the Anterior Peroneal.

The Surgical Collateral Branch of the **Posterior Tibial** is the Peroneal, because it anastomoses through its anterior terminal branch with the Tarsal arteries from the Dorsal and the Anterior Tibial.

COLLATERAL CIRCULATION AFTER LIGATURE (i. e., HOW THE PARTS BEYOND THE LIGATURE ARE SUPPLIED).

- 461 **Guide.** Name in order each important branch originating from the ligated artery (above or below the point of ligature), and say with what artery it anastomoses.

Collateral Circulation After Ligature of the Innominate.

Anastomoses of the branches of the *External Carotid* with their fellow of the opposite side.

Anastomoses of the *Two Internal Carotids* in the Circle of

Willis through the Anterior Communicating of the *Anterior Cerebrals*.

Anastomoses of the *Two Vertebrales* in the Circle of Willis through the Two Posterior Cerebrals of the Basilar.

Anastomoses of *Descending Cervical* from Occipital with the Ascending Cervical of the Superior Intercostal (subclavian).

Anastomoses of *Long Thoracic and Subscapular* of axillary with Perforating Aortic Intercostals.

Collateral Circulation After Ligature of the Common Carotid.

Anastomoses of *External Carotid* with its fellow.

Anastomoses of *Descending Cervical* (external carotid) with the Ascending Cervical (superior intercostal of subclavian).

Anastomoses of *Internal Carotid* with its fellow in the circle of Willis through the Anterior Communicating.

Anastomoses of *Internal Carotid* with the Vertebral in the circle of Willis through the Posterior Communicating.

Collateral Circulation After Ligature of the External Carotid.

Anastomoses of *its Branches* with their fellows.

Anastomoses of *Facial* with Nasal (ophthalmic).

Anastomoses of *Descending Cervical* (occipital) with Ascending Cervical (superior intercostal subclavian).

Collateral Circulation After the Ligature of the Internal Carotid.

Anastomoses of *Nasal* (ophthalmic) with Facial (external carotid).

Anastomoses with *its Fellow* in the circle of Willis through the Anterior Cerebral.

Anastomoses of the Posterior Cerebral with the Vertebral in the circle of Willis.

462 Collateral Circulation After the Ligature of the First Portion of the Subclavian, i. e., inside the origin of all its branches.

Anastomoses of *Vertebral* with its fellow in the circle of Willis through the Basilar.

Anastomoses of the *Inferior Thyroid* with the other Thyroids in the Thyroid Body.

Anastomoses of the *Superior Intercostal* through the Ascending Cervical with the Descending Cervical of the Occipital (external carotid).

Anastomoses of the *Internal Mammary* with the Epigastric (external iliac).

Anastomoses of the *Anterior Scapular* with Subscapular (axillary).

Anastomoses of the *Subscapular and Long Thoracic* (axillary) with Perforating Intercostal (aorta).

Collateral Circulation After the Ligature of Second, or

Third Portions of the Subclavian, i. e., outside the origin of all its branches; and

Collateral Circulation After the Ligature of the First Portion of the Axillary, i. e., above the Small Pectoral, i. e., above the origin of the Long Thoracic (axillary).

These three ligatures are practically all the same as regards the collateral circulation.

Anastomose of the *Scapulars* (subclavian) with the Subscapular (Axillary).

Anastomose of the *Long Thoracic* with Perforating Intercostals.

Anastomose of *Subscapular* with Perforating Intercostals.

Anastomose of *Circumflex* with the Two Scapulars of the Subclavian.

Collateral Circulation After the Ligature of the Axillary in its Third Portion, i. e., below the origin of the Subscapular, and

463 Collateral Circulation After Ligature of the Brachial Above the Origin of the Superior Deep Brachial.

These two ligatures are practically the same.

Anastomose of the *Subscapular* (axillary) with the Ascending Branch of the Superior Deep Brachial.

Anastomose of the *Circumflex* (axillary) with same.

Collateral Circulation After Ligature of the Brachial Below the Superior Deep Brachial, but Above the Inferior Deep Brachial.

Anastomoses of the *Superior Deep Brachial* with Recurrent Radial and the Elbow Circle.

Collateral Circulation After Ligature of the Brachial at the Bend of the Elbow, i. e., below the origin of all its branches.

Anastomose of the *Superior Deep Brachial* with Recurrents and Elbow Circle.

Anastomoses of the *Inferior Deep Brachial* with same.

Anastomoses of the *Great Anastomotie* with same.

Collateral Circulation After the Ligature of the Radial Alone.

Anastomoses through the Two Palmar Arches.

Collateral Circulation After the Ligature of the Ulnar Alone.

Anastomoses through the Two Palmar Arches.

Collateral Circulation After the Ligature of the Radial and Ulnar Simultaneously.

Anastomoses of the Interosseous with the Carpals and Metacarpal Arteries (from radial and from ulnar).

464 Collateral Circulation After the Ligature of the Common Iliac.

Anastomoses through *Branches of Internal Iliac*.

Anastomose of Ilio-lumbar (internal iliac) with Lumbar (aorta).

Anastomoses of Visceral Branches of internal iliac with their fellows.

Anastomose of *Lateral Sacral* (internal iliac) with Middle Sacral (aorta).

Anastomoses through *Branches of the External Iliac*.

Anastomose of *Epigastric* (external iliac) with Internal Mammary (subclavian).

Anastomose of *Circumflex Iliac* (external iliac) with Lumbar (aorta).

Collateral Circulation After the Ligature of the Internal Iliac.

Anastomoses of *Vesical Branches* (internal iliac with their fellows).

Anastomose of *Ilio-lumbar* (internal iliac) with Lumbar (aorta).

Anastomose of *Obturator* (internal iliac) with Circumflex (femoral).

Anastomose of *Lateral Sacral* (internal iliac) with Middle Sacral (aorta).

Anastomose of *Ischiatic* (internal iliac) with Deep Femoral.

Collateral Circulation After Ligature of the External Iliac.

Anastomose of *Epigastric* with Internal Mammary (subclavian).

Anastomose of *Circumflex Iliac* with Lumbar (aorta).

Anastomose of *Circumflex* (femoral) with Obturator (internal iliac).

Anastomose of *Deep Femoral* with Ischiatic (internal iliac).

465 **Collateral Circulation After Ligature of the Common Femoral.**

Anastomose of *Deep Femoral* with Ischiatic (internal iliac).

Anastomose of *Circumflex* (femoral) with Obturator (internal iliac).

Collateral Circulation After the Ligature of the Superficial Femoral Above the Origin of the Great Anastomotic.

Anastomoses of *Deep Femoral* with Articulars (popliteal).

Collateral Circulation After the Ligature of the Popliteal Above the Posterior Ligament.

Anastomoses of *Great Anastomotic* (femoral) with Recurrent Tibial and the Inferior Articulars.

Anastomoses of *Superior Articulars* (popliteal) with the Inferior Articulars (popliteal).

Collateral Circulation After the Ligature of the Popliteal Below the Posterior Ligament.

Anastomose of the *Great Anastomotic* (femoral) with Recurrent Tibial (anterior tibial).

Anastomose of *all the Articulars* (popliteal) with Recurrent Tibial.

Collateral Circulation After the Ligature of the Anterior Tibial.

Anastomose of Dorsal Artery with External Plantar (posterior tibial).

Collateral Circulation After the Ligature of the Posterior Tibial.

Anastomoses of *External Plantar* with Dorsal Artery (anterior tibial).

Collateral Circulation After the Ligature of the Peroneal.

Anastomoses of *Dorsal Artery* (anterior tibial) with Anterior and Posterior Peroneals.

Collateral Circulation After Simultaneous Ligature of the Anterior and Posterior Tibials.

Anastomoses of *Dorsal Artery* (anterior tibial) with Anterior and Posterior Peroneals.

Anastomoses of *External Plantar* (posterior tibial) with Dorsal Artery and the Anterior and Posterior Peroneals.

Collateral Circulation After the Simultaneous Ligature of the Anterior Tibial, Posterior Tibial and Peroneal.

Anastomoses through muscular branches.

RESUMÉ OF THE VEINS OF THE SYSTEMIC CIRCULATION.

466 **Divisions:** The veins above the diaphragm all end in the *Superior* or *Descending Cava*, and all the veins below the diaphragm end in the *Inferior* or *Ascending Cava*.

SUPERIOR OR DESCENDING CAVA VEIN.

Course. It extends from the junction of the two innominate veins which form it to the upper part of the right auricle.

Situation or Relations. The Superior Cava is in relation:

In Front, with the first intercostal space, the second costal cartilage, the corresponding portions of the border of the sternum and the second intercostal space.

Behind, with the root of the right lung.

Externally, with the apex of the right lung.

Internally, with the origin of the aorta.

Collateral Branches: The *Great Azygos*.—It is situated in the posterior mediastinum, to the right of the vertebral column and thoracic duct;—it arches over the pedicle of the right lung;—it empties into the descending cava.—It returns the blood from the intercostal spaces, except the three

upper.—Its formative branch communicates with the *renal*, and even the ascending cava.

Formative Branches: The left and right innominate veins.

LEFT INNOMINATE VEIN.

467 Course: It is much the longer, having to cross over to the right side to form the ascending cava.

Situation or Relations. It is in relation:

In Front, with the upper border of the sternum, about one-quarter of an inch below it; also the right sterno-clavicular articulations.

Behind, with the left subclavian artery, left common carotid, innominate artery, pneumo-gastric nerve, phrenic nerve, thoracic duct.

Collateral Branches: It receives all the veins which accompany the branches of the subclavian artery, except the scapulars.

It receives also the great thoracic duct.

Formative Branches: Left internal jugular and subclavian.

RIGHT INNOMINATE VEIN.

468 Course: Is remarkably short.

Situation or Relations. It is in relation:

In Front, with the right sterno-clavicular articulation.

Behind, with the innominate artery.

Collateral and Formative Branches: Same as for left innominate, except that it receives the right lymphatic duct instead of the thoracic duct.

INTERNAL JUGULAR VEIN.

469 Course: It extends almost perpendicularly from the base of the skull to the superior cava.

Situation or Relations. It is in relation:

In Front, below, with the tendon of the sterno-mastoid; in the middle, with its anterior border only; above, with the skin and fascia.

Behind, with the vertebral column, the pneumo-gastric and the sympathetic.

Internally, with the common carotid and the internal carotid.

Externally, with the deep cervical lymphatic glands, the parotid gland and the pterygoid muscles.

Collateral Branches: The veins which accompany the branches of the external carotid artery, except the internal maxillary, the posterior auricular and temporal veins (which are the formative branches of the external jugular).

Formative Branches: The two lateral sinuses and the inferior petrosal sinus.

LATERAL SINUSES.

470 **Situation and Course:** They extend horizontally from the Press of Herophilus on the left side of the internal occipital protuberance to the mastoid process;—then they curve inwards and downwards to the jugular foramen.

Collateral Branches: 1st, *Veins* from cerebellum and diploë;—2d, *Mastoid Vein*;—3d, *Superior Petrosal Sinus*, which originates from the cavernous sinus and runs along the superior border of the petrous bone.

Formative Branches: The superior longitudinal sinus, the straight sinus and the occipital sinus.

SUPERIOR LONGITUDINAL SINUS.

471 **Situation and Course.** It corresponds to the convex or adherent border of the cerebral falx.—(*This sinus, the Cavernous Sinuses and Lateral Sinuses are the largest sinuses of the brain.*)

Collateral Branches: Cerebral and diploic veins.

Formative Branches: Superior nasal vein, which passes through the so-called blind foramen.

STRAIGHT SINUS.

472 **Situation and Course.** It is situated at the base of the cerebral falx, where it joins the tentorium.

Collateral Branches: 1st, the *cerebral veins*;—2d, the inferior longitudinal sinus, which is a small venous tract corresponding to the free or concave border of the cerebral falx.

Formative Branches: The *Veins of Galen* from the interposed veil.

OCCIPITAL SINUSES.

473 **Situation and Course:** They are two small tracts, situated on the margin of the occipital foramen.

INFERIOR PETROSAL SINUSES.

Situation and Course. They are situated along the posterior border of the petrous bone;—they extend from the cavernous sinus to the jugular foramen.

Collateral Branches: The *Transverse Sinus*, which is situated in front of the occipital foramen, and which establishes a transverse communication with the same sinus on the other side.

Formative Branches: The cavernous sinuses.

CAVERNOUS SINUSES.

- 474 **Situation and Course.** They are situated on the sides on the pituitary body.

They contain the internal carotid artery, the third, fourth, first branch of the fifth and the sixth pairs of nerves.

Collateral Branches: 1st, *Cerebral Veins*;—2d, the *Circular Sinus*, which surrounds the pituitary body in the sella turcica and which establishes a communication with the cavernous sinus on the other side.

Formative Branches: The *Ophthalmic Vein*, which returns the blood from all the parts contained in the orbit behind the broad ligaments of the lids.—It inosculates with the facial vein at the internal angle of the eye.

CLASSIFICATION OF THE SINUSES.

- 475 **Important Sinuses:** The only important sinuses are the Lateral, the Superior Longitudinal, the Straight, the Superior Petrosal, Inferior Petrosal, the Transverse and the Cavernous.

The **Cerebral Sinuses** are the first three, the Lateral, Superior Longitudinal and the Straight, which return the blood from the brain alone.

The Superior Longitudinal receives the blood from the surface of the brain.

The Straight Sinus receives the blood from the interior of the brain through the interposed veil and the Veins of Galen.

The **Orbital Sinuses** are the Cavernous and the Inferior Petrosal Sinuses, which return the blood from the orbit through the ophthalmic vein.

Anastomotic Sinuses:

The Superior Petrosal Sinus is an anastomotic branch between the Cerebral and the Orbital Sinuses. It corresponds to the posterior communicating artery.

The Transverse is an anastomotic branch between the cavernous sinuses of the two sides. It corresponds to the anterior communicating artery.

The two Lateral Sinuses anastomose through the Press of Herophilus.

ANASTOMOSES BETWEEN THE INTRA-CRANIAL AND THE EXTRA-CRANIAL VENOUS CIRCULATIONS.

- 476 1st. Anastomose of the facial with the ophthalmic at the internal angle of the eye.

2d. Anastomose of the superior nasal vein with the superior longitudinal sinus.

3d. Anastomose of the superficial parietal veins with the superior longitudinal sinus by means of the veins of Satorius, which pass through the parietal foramina.

4th. Anastomose of the superficial occipital veins with the lateral sinuses by means of the mastoid veins, which pass through the mastoid foramen.

5th. Anastomose of the deep veins of the outside of the base of the cranium with the lateral sinus by means of the condyloid vein, which passes through the posterior condyloid foramen.

6th. Anastomose between the superficial veins and the sinuses by means of the *Diploic Veins*.

SUBCLAVIAN VEIN.

477 Course: It extends from the innominate vein to the outer border of the first rib, where it becomes the axillary.

Situation or Relations: The Subclavian Vein is in rotation:

In Front, with the sterno-clavicular articulation.

Behind, with the subclavian artery, from which it is separated by the anterior scalene, the pneumo-gastric and phrenic nerves.

Below, with the pleura and the first rib.

Above, with the large lymph ducts and the skin.

Collateral Branches: 1st. Of all the veins accompanying the branches of the subclavian artery it receives only the *Anterior* and *Posterior Scapular veins*, but it receives the anterior, external and posterior jugular veins, and the cephalic.

2d. The *Anterior Jugular* runs downwards, along the anterior border of the sterno-mastoid,—then outwards across the sternal and clavicular tendons of this muscle.—It opens into the subclavian just behind the posterior border of the clavicular tendon.—It is situated above the fascia and underneath the platysma and skin.—It returns the blood from the superficial median parts of the neck.

3d. The *External Jugular* extends from the space between the mastoid process and the angle of the jaw, downwards and backwards, to the junction of the posterior border of the sterno-mastoid and the clavicle.—It crosses the sterno-mastoid at an acute angle; also the fibres of the platysma.—It is situated over the cervical fascia and underneath the skin and platysma.—It often receives the posterior jugular and the anterior and posterior scapular veins.—It is formed by the junction of the temporal and internal maxillary veins.

4th. The *Posterior Jugular* is deeply seated between the muscles of the back of the neck;—it is often of large size.—It terminates in the external jugular about the middle of the neck.

5th. The *Branch from the Cephalic* crosses over the clavicle and opens near the border of the trapezius.

Formative Branch: The axillary.

AXILLARY VEIN.

478 **Course.** It extends from the outer border of the first rib to the tendons of the great dorsal and great pectoral.

Situation or Relations: The Axillary Vein is in relation:

In Front, with the costo-clavicular membrane and the small pectoral muscle.

Behind, with the axillary artery, which it uncovers a little only beyond the small pectoral muscle.

Collateral Branches: 1st, *All the veins* which accompany the branches of the axillary artery, the *subscapular vein* especially;—2d, it often receives the *Deep Basilic Vein*;—3d, the *Cephalic*, which extends from the elbow to the clavicle;—it ascends along the outer border of the biceps, then lies in the pectoro-deltoid groove—and opens into the axillary immediately below the clavicle,—after giving off a superficial branch to the subclavian vein.

Formative Branches: Are the deep and the superficial veins of the upper extremity.

The *Deep Veins* are the two brachial veins which accompany the brachial artery; they are themselves formed by the two deep radial veins and the two deep ulnar veins.

The **Superficial Veins** are the Median, the Superficial Radial, the Superficial Ulnar, the Median Basilic, the Median Cephalic, the Basilic and the Cephalic.

The **Median Vein** runs along the middle of the forearm, from the wrist to the bend of the elbow, where it divides into the median cephalic and the median basilic.

The **Median Cephalic** passes upwards and outwards, and is joined by the superficial radial vein.

The **Median Basilic** runs along the inner groove, crossing obliquely the brachial artery, the deep brachial veins and the median nerve, from which it is separated by the fibrous expansion of the biceps; it is joined by the superficial ulnar.—It receives a large anastomotic branch from the deep veins.

The **Superficial Radial** ascends along the index finger and thumb, and then on the radial side of the front of forearm to the bend of the elbow, where it joins the median cephalic, the two forming the cephalic vein.

The **Superficial Ulnar** ascends along the little finger, then along the ulnar side of the front of the forearm to the bend of the elbow, where it joins the median-basilic to form the basilic vein.

The **Basilic Vein** ascends along the inner border of the biceps to the lower third of the arm, where it pierces the fascia and joins one of the deep brachial veins.

The **Cephalic Vein** ascends subcutaneously along the outer border of the biceps, then between the deltoid and the pectoral to near the clavicle, where it discharges into the axillary.

INFERIOR OR ASCENDING CAVA VEIN.

479 **Course.** It extends from the fourth lumbar vertebra to the right auricle of the heart.

Situation or Relations. It is in relation :

In Front, with the mesentery, the head of the pancreas, the special groove of the liver and the fibrous opening in the diaphragm.

Behind, with the vertebral column and pillar of diaphragm.

On the Left with the Aorta.

On the Right with the psoas.

Collateral Branches: It receives the portal hepatic system of veins, the reno-genital veins and the parietal veins.

1st. The **Portal Vein** is formed by the *Splenic* and the *Superior Mesenteric Veins*.

Previously to joining the splenic, the Superior Mesenteric receives the *Inferior Mesenteric*.

The Portal Vein extends from the neck of the pancreas to the transverse fissure.—It is situated in the left of the gastro-hepatic omentum, behind the common bile duct and the hepatic artery, in front of the foramen of Winslow and the ascending cava.

It ascends into the interior of the liver.

In the lobules its capillaries and those of the arteries are succeeded by the capillary radicles of the hepatic veins, which all gather in the centre of the lobules.

The hepatic radicles finally form three large *Hepatic Veins* which open into the ascending cava, along the upper border of the liver.

The walls of the hepatic veins adhere to the hepatic tissue and remain gaping when cut across.

2d. The **Reno-genital** veins are the supra-renal, the renal and the spermatic veins.

3d. The Ascending Cava receives also the parietal veins, the *phrenic*, the *lumbar* and the *spinal* veins.

Formative Branches: Are the two common iliac veins.

COMMON ILIAC VEIN.

480 **Situation and Course:** It extends from the sacro-iliac junction to the ascending cava.

The *Right* is at first on the inner side of the artery, then passes under to its outer side.

The *Left* is larger and longer than the right.—It is at first

under the left artery, then crosses in front of the fourth lumbar vertebra and passes under the right artery.

They are both covered by the peritoneum and are crossed by the ureters.

Collateral Branches: The *ilio-lumbar*, the *lateral sacral* and the *spinal* veins.

Formative Branches are the internal and the external iliac veins.

INTERNAL ILIAC VEIN.

481 It corresponds to the artery, but is placed behind it.

EXTERNAL ILIAC VEIN.

Situation and Course: It extends from Poupart's ligament to the sacro-iliac articulation.—There it joins the internal iliac to form the common iliac.—Near the crural arch it is on the inner side of the artery, but higher up it passes under it and then is on its outer side.

Collateral Branches: The *circumflex iliac* veins and the *deep epigastric* veins.

Formative Branch is the femoral vein.

FEMORAL VEIN.

482 **Situation and Course:** It follows the artery.—Beneath Poupart's ligament it is on the inner side of the artery;—in the middle third of the thigh it is behind it;—at the lower third it is on the outer side.

Collateral Branches:

1st. The *Veins corresponding* to branches of the arteries.

2d. The *Internal Saphenous Vein*, which is a superficial vein.—It ascends along the inner side of the foot—and then in front of the inner malleolus and the internal border of the tibia.—It ascends behind the inner condyle of the femur;—thence upwards and a little forwards—to the special opening for it, the saphenous opening, in the fascia lata, about one inch below Poupart's ligament.

Formative Branch is the popliteal.

POPLITEAL VEIN.

483 **Course:** It extends from the ring in the great adductor to arch of the soleus.

Situation and Relations:

Above the knee it is on the outer side of the artery and on the inner side of the nerve.

Opposite the knee it covers the artery and is covered by the nerve.

Below the knee it lies on the inner side of the artery and on the outer side of the nerve.

- 484 **Collateral Branches:** Are the deep veins and the external saphenous vein.

1st. The *Deep Veins* are the branches accompanying the articular arteries.

2d. The *Short Saphenous Vein* ascends along the outer border of the foot,— passes behind the external malleolus,— ascends along the outer border of the Achilles tendon,— and thence along the middle line of the back of the leg to the middle of the popliteal space ;—there it opens into the popliteal vein.

Formative Branches are the deep veins of the leg and foot which accompany the arteries: the two *anterior tibial* veins, the two *dorsal veins of the foot*, the two *posterior tibial* veins, the two *external and internal plantar* veins, and the two *peroneal* veins.

PECULIARITIES OF VEINS IN PARTICULAR.

- 485 *Large Arteries* are accompanied by only one large vein except the brachial, which has two small ones.

Veins going through muscles or coming from muscles are the only ones provided with valves.

Large Veins are always alongside or on top of arteries, never under, with but two or three exceptions, which will be explained further.

Often the vein is the more superficial and is first met by the knife.

They often *overlap* the artery considerably.

The **Superior Cava** receives but one collateral branch, the great Azygos, which arches over the pedicle of the right lung.

The **Left Innominate** crosses from the left to the right and is, therefore, much longer than the right.

It receives the Thoracic Duct.

The **Right Innominate** is much shorter.

It receives the Right Lymphatic Duct.

The **Innominate Veins** receive almost all the branches which correspond to the arterial branches of the subclavian arteries.

The **Internal Jugular Vein** adheres to the posterior lacerated foramen.

It usually adheres close but loosely to the sterno-mastoid.

It anastomoses freely with its fellow through the lateral sinus.

The **Inferior Thyroid, the Lingual and the Facial Veins**, branches of the Internal Jugular, cross on top of the corresponding arteries.

The **Head** has two remarkable *Superficial Veins*, the Frontal and the Temporal.

The **Face** has a Superficial Vein, the Facial.

It follows the artery, but runs a straighter course.

It inosculates with the ophthalmic at the internal angle of the eye.

486 The **Neck** has peculiar superficial or subcutaneous veins, which are the External and the Anterior Jugular Veins.

(We have also similar subcutaneous veins in the arm and leg, none in the trunk.)

The **Subclavian Vein** adheres to the fascia of the omo-hyoid.

The **Axillary Vein** overlaps the artery considerably, especially in its two first portions.

The **Brachial Veins** are two in number, whereas there is but one femoral vein.

The *Upper Extremity* has peculiar superficial or subcutaneous veins, which are the Median Basilic and the Median Cephalic, the Cephalic and the Basilic.

The *Thoracic Walls* are drained by a peculiar vein, the Great Azygos, which arches over the pedicle of the right lung to discharge into the Superior Cava.

The **Inferior Cava Vein** is much larger after receiving the Hepatic Veins; also after receiving the Renal Veins.

The peculiarities of these veins have already been described.

The **Common Iliacs** and the **External Iliacs** pass under the arteries.

The **Femoral Vein** winds around the artery so that above it is internally, then posteriorly in the middle of the thigh, then externally in Hunter's canal.

The **Popliteal Vein** crosses the artery obliquely.

It is on the top of the artery.

It is below the nerve.

The *Lower Extremity* has two peculiar superficial or subcutaneous veins: the Long or Internal Saphenous, and the Short or External Saphenous.

PECULIARITIES OF THE VEINS OF SOME ORGANS.

ORGANS OF DIGESTION.

487 **Lips:** The veins of the Upper Lip discharge into the Facial, which itself inosculates with the ophthalmic, and these with the Cavernous Sinus and the Sinuses of the Brain.

Tongue: The Ranine Veins are visible through the mucous membrane.

Parotid: The Temporal and the Internal Maxillary Veins join the substance of the parotid to form the External Jugular.

Stomach, Small and Large Intestines to Anus.—Their Veins form the Portal System.—They have no valves.

Spleen : Its veins also form the portal system.— It has no valves also.

The venous capillaries begin by dilated extremities.

Liver : It receives the Portal Vein.

It presents the Central Intra-lobular Hepatic Vein.

The Hepatic Veins discharge along the upper border into the Ascending Cava, instead of coming out of the organ at the hilum.

The hepatic veins adhere to the hepatic tissue and remain gaping when cut across.

They have no valves.

There are two hepatic veins for the right lobe.

There is only one for the left lobe.

ORGANS OF URINATION.

488 **Kidneys :** *Renal Veins.*

The Right is lower than the left.

The Left is longer than the right, and crosses over from the left to the right.

They are remarkable for their size.

They originate from the capillary plexus around the lobules.

They have no valves.

They contain redder blood than the arteries.

The Right receives the Spermatic Veins direct.

They anastomose with the lowest branches of the Azygos.

Bladder :

The neck is surrounded by a well marked plexus, which receives the Dorsal Vein of the Penis.

Prostate : It is also surrounded by a plexus of veins.

ORGANS OF GENERATION.

Scrotum :

Its veins discharge into the superficial veins.

Testicle and Epididymis :

The veins follow the Spermatic Duct.

They are loosely connected with the duct, whereas the arteries are closely attached to the duct.

On the Right they discharge into the Renal Vein.

On the Left they discharge into the Pampiniform plexus.

They have no valves.

Penis :

Has one Single Dorsal Vein.

It originates by open dilated extremities.

It discharges into the Vesical Plexus.

It has no valves.

HEART

489 The **Proper Tissue or Walls** present the Great Coronary Vein and the Small Veins of Thebesius.

The *Great Coronary Vein*:

Returns the blood from the tissues or walls of the thick left heart.

It has valves in its course.

It presents the Thebesian Valve, at its opening into the right auricle.

The *Small Veins or Veins of Thebesius*:

They return the blood from their right walls and open directly into the auricle.

The **Right Auricle** receives:

The Veins from the walls.

The Superior Cava returning the blood from all the supra-diaphragmatic parts of the body.

The Inferior Cava, returning the blood from all the infra-diaphragmatic parts of the body.

The **Left Auricle** receives:

The Four Pulmonary Veins.

They have no valves.

They contain red blood.

The left Pulmonary Veins are longer.

ORGANS OF RESPIRATION.

490 **Bronchi**:

Their Veins are separate or distinct from the pulmonary veins.

They discharge into the Azygos veins, or some close branch.

Lungs:

They present the four Pulmonary Veins.

They originate from the walls of the air vesicles.

They have no valves.

They discharge into the left auricle.

The left are longer.

They contain red blood.

Thyroid Body:

The Veins are large and numerous.

CENTRAL ORGANS OF INNERVATION.

491 **Dura Mater of Brain**:

It presents the Sinuses of the Brain, already described.

Cerebral Veins.

Superficial Cerebral Veins:

They are situated in the pia mater.

They open into the Superior Longitudinal Sinus, against the course of the blood.

They discharge in the various neighboring sinuses.

Deep Cerebral Veins:

They originate from the choroid plexuses, and from the walls of the interior cavities.

They form the Veins of Gallen, situated in the substance of the Interposed Veil.

The Veins of Gallen emerge through the transverse fissure of the brain and open into the Straight Sinus.

Spinal Veins:

Are large and numerous.

They empty during ventricular systole, and make room for the cerebro-spinal fluid from the cranium.

ORGANS OF SPECIAL SENSE.

492 **Nose:**

Its veins discharge into the parotid and the facial, which inosculates with the ophthalmic.

Nasal Cavities:

The Veins at the Roof anastomose with the Superior Longitudinal Sinus.

Eyeball and Orbit:

All the veins behind the Broad Ligament discharge into the ophthalmic, and these same discharge into the Cavernous Sinus.

Choroid:

Its veins are the Four Vorticose Veins.

They emerge from the eye at a point different from the point of entrance of the arteries.

The Capillary Veins are also Vorticose.

Retina:

The vein, like the artery, divides in the optic papilla into an upper and lower arched branch.

Iris:

Its veins discharge into the Circular Sinus or Canal of Fontana.

Eyelids:

All the veins in front of the Broad Ligament discharge into the Facial.

All the veins behind it discharge into the Ophthalmic.

BONES.

493 **Diploë of Bones of Skull:**

Presents Sinuses.

Venules are usually attached to the bony tissue, hence hemorrhages and sepsis.

MUSCLES.

All veins which traverse muscles, or which come from them, are provided with valves.

ARTERIES AND VEINS.

Veins of Arteries and of Veins, *i. e.*, Veins of the Walls of Arteries and of Veins:

They discharge into neighboring small venules, not into the main trunk.

RESUMÉ OF THE LYMPHATIC SYSTEM.

494 **Structure of Lymphatic Vessels:** They have the same structure as the small veins.

The radicles of the lymphatics originate:—1st, in spaces between the fascicules of the connective tissue called the *lymph spaces*;—2d, in the spaces between the so-called follicles of the lymphoid organs and called the *lymph sinuses*;—3d, on the surface of the serous membranes by *minute orifices*.

N. B.—There is nowhere any communication between the lymph radicles and the capillaries, either direct or indirect.

495 **Structure of Lymphatic Glands.**

They are composed of:

1st. A *Cortical* and a *Medullary portion*.

2d. An *Envelope* or *Capsule*, which is formed of delicate fibrous tissue.

3d. A *Proper Substance*, which is composed of alveoles filled with lymphoid cells.

4th. Of *Afferent Lymphatics*, which penetrate the periphery of the gland and terminate by a free opening into the alveoles.

5th. Of *Efferent Lymphatics*, which originate also by free openings and come out through the hilum.

LYMPH.

496 The anatomical elements are the *Lymph Corpuscles*, which resemble the white corpuscles of the blood.

The lymph corpuscles are few before passing through the lymphatic glands; the lymph (and the chyle) receive their corpuscles from lymphatic glands.

CHYLE.

497 The anatomical elements are the *Chyle Corpuscles*.

They are analogous to the lymph corpuscles.

Chyle presents also fatty granules, oil globules, free nuclei and few red blood corpuscles.

The *Granular Substance* of the chyle poured into the large

veins of the neck disappears as the blood passes through the lungs.

Like the lymph, chyle contains no corpuscles before entering the lymphatic glands, but they are numerous after leaving the glands.

The milky appearance of the chyle in mammals is due to innumerable minute dust-like particles formed by globules of fat enclosed in a layer of albumen.

The *Coagulum of Lymph* and *Chyle* may become red by exposure to air.

THORACIC DUCT.

498 **Length:** It is about one foot long.

Situation and Course: It extends from the fourth lumbar vertebra to the junction of the left internal jugular and subclavian veins.

It ascends in front of the vertebral column lying to the right of the aorta and to the left of the ascending cava.

It passes into the chest through the aortic opening of the diaphragm, and ascends between the aorta on the left and the great azygos vein and œsophagus on the right.

At the upper part of the chest it arches over the left subclavian artery to open as already described.

Its opening is guarded by a valve.

Collateral Branches: It receives all the lymphatics from the glands of the left side of the head and neck, left arm, left side of chest.

Formative Branches are the lymphatics from the lumbar and aortic glands, which themselves receive the lymphatics from the glands of the abdominal and pelvic viscera and walls (both sides), and from the two lower limbs.

RIGHT LYMPHATIC DUCT.

499 **Length:** It is not more than one inch long.

Situation and Course: It extends from the right supraclavicular region to the superior mediastinum.

It is situated behind the right subclavian artery, near its junction with the common carotid.

It arches over the right subclavian artery.

It opens at the point of junction with the right internal jugular and subclavian veins.

Its opening is guarded by a valve.

Collateral and Formative Branches: It receives all the superficial and deep lymphatics from the right side of the face, neck and chest; also from the right upper extremity

SITUATION OF THE LYMPHATIC GLANDS AND THEIR AFFERENT AND EFFERENT VESSELS.

N. B.—The *Deep Lymphatics* follow the deep vessels to reach their glands.

The *Superficial Lymphatics* follow the main superficial vein of the region to reach their glands (as facial, ulnar, basilic, internal saphenous veins).

HEAD.

- 500 1st. The **Buccal Glands** (on buccinator muscles) receive lymphatics from the frontal region, which run along the frontal and facial veins and discharge into the deep cervical glands.
- 2d. The **Parotid Glands** receive the lymphatics from the ear, temple, outer part of the eyelids, upper part of the cheek, and discharge into the deep cervical glands.
- 3d. The **Posterior Auricular Glands** receive lymphatics from the skin of neighboring parts and discharge into the deep cervical glands.
- 4th. The **Occipital Glands** receive lymphatics from the occipital region and discharge into the deep cervical glands.

NECK.

501 **Superficial Lymphatic Glands:**

- 1st. The **Digastric Glands** receive the lymphatics from the middle of the lower lip and discharge into the deep cervical glands.
- 2d. The **Submaxillary Glands** receive the lymphatics from the outer part of the lips and discharge into the deep cervical glands.
- 3d. The **Supra-clavicular Glands** receive lymphatics from the skin of neighboring regions and discharge into the large lymphatic ducts.

Deep Lymphatic Glands:

The **Upper Carotid or Cervical and Deep Parotid** receive the lymphatics from the meninges, cerebrum, nasal cavities, pharynx, mouth, temporal and orbital fossæ, and discharge into the inferior carotid glands.

The **Inferior Carotid or Cervical Glands** receive the lymphatics from the pharynx, larynx, trachea, œsophagus and thyroid gland, and discharge into the large ducts.

UPPER EXTREMITY.

502 **Superficial Glands:**

The **Epitrochelar Glands** receive the *inner* lymphatics of

palmar extract of forearm—and discharge into the axillary glands.

Deep Lymphatic Glands:

The radial, ulnar, and brachial (very small glands) are situated along the arteries;—they discharge into the axillary glands.

Axillary Glands: 1st. *Group:* around the axillary artery and vein;—they receive all the vessels from the above glands, the neck, upper umbilical region of back and the shoulders.—They discharge into the subclavian glands.

2d. *Group:* along the lower border of the great pectoral;—they receive lymphatics from epigastrium, mammary glands, the sides of the chest.—They discharge into the subclavian glands.

Subclavian Glands (around subclavian vessels): they receive all the vessels from the above glands.—They discharge into the large ducts.

CHEST.

503 1st. The **Anterior Mediastinal Glands** receive lymphatics from the diaphragm and the convexity of the liver,—and discharge into large ducts.

2d. **Internal Mammary Glands** receive lymphatics from parts supplied by the artery—and discharge into the large ducts.

3d. **Superior Mediastinal Glands or Cardiac Glands** receive lymphatics from the heart, pericardium and thymus gland,—and discharge into the thoracic duct.

4th. The **Intercostal Glands** receive lymphatics from parts supplied by the arteries,—and discharge into the large ducts.

5th. The **Posterior Mediastinal Glands or Aortic and Œsophageal** receive lymphatics from Œsophagus, aorta and areolar tissue,—and discharge into the large ducts.

9th. The **Bronchial Glands** receive lymphatics from the bronchi and lungs,—and discharge into the thoracic duct.

ABDOMEN.

504 1st. The **Gastric Glands** (along the concave border) receive the lymphatics from stomach;—the efferent lymphatics discharge into aortic glands.

2d. The **Hepatic Glands** (in gastro-hepatic omentum) receive lymphatics from liver and stomach;—the efferent lymphatics discharge into aortic glands.

3d. The **Splenic Glands** (in the hilum and gastro-splenic omentum) receive lymphatics from spleen and stomach;—the efferent lymphatics discharge into the aortic glands.

4th. The **Mesenteric Glands** receive lymphatics from the intestines; they are the *lacteals*;—they discharge into the thoracic duct.

5th. The **Lumbo-psoas Glands** (in front of insertions of psoas muscles) receive lymphatics from supra-renal capsules, kidney, body of the uterus, oviduct, ovary, testicles;—they discharge into the thoracic duct.

6th. The **Aortic Glands** extend from aortic opening to the bifurcation;—they receive lymphatics from stomach, intestines, liver, spleen, pancreas;—they discharge into the thoracic duct.

PELVIS.

505 1st. The **Sacral Glands** receive the lymphatics from the rectum, bladder, neck of uterus, seminal vesicles and prostate;—they discharge into the thoracic duct.

2d. The **Internal Iliac Glands** receive the lymphatics from rectum, bladder, neck of uterus;—they discharge into the lumbar glands.

3d. The **Gluteal and Ischiatic Glands** are situated along the course of the gluteal vessels;—they receive the lymphatics accompanying the gluteal, ischiatic and obturator arteries;—they discharge into the internal iliac glands.

4th. The **External Iliac Glands** receive the lymphatics accompanying the epigastric and circumflex iliac arteries;—they discharge into the lumbar glands.

LOWER EXTREMITY.

506 1st. **Superficial Glands.**

Superficial Inguinal:

The *External Glands* receive the lymphatics from the skin of the buttocks and loins.

The *Middle* receive the lymphatics from the skin below the umbilicus (outer half).

The *Internal* receive the lymphatics from the inner half of the skin of the buttocks, loins, perineum, anus, scrotum, penis, vulva, and origin of mucous membrane of vagina.

They all discharge into the deep scarpal glands.

The **Superficial Scarpal** or **Saphenous Glands** receive all the superficial lymphatics of the thigh and leg,—and discharge into the deep scarpal glands.

2d. **Deep Glands.**

The *Deep Scarpal* or *Femoral Glands* receive the lymphatics from the popliteal glands and the superficial glands,—and discharge into the external iliac glands.

The **Popliteal Glands** and **Anterior Tibial Glands** receive the lymphatics from the parts supplied by the vessels—and discharge into the Scarpal glands.

PECULIARITIES OF LYMPHATICS.

- 507 The Lymphatics of the right side of the head, neck, arm and chest, discharge into the Right Lymphatic Duct.

The Lymphatics of the balance of the body, *i. e.*, of the left side of head, neck, arm, chest, of both sides of the abdomen and back, and of the two lower limbs, discharge into the Great Thoracic Duct.

The Lymphatics, whether Deep or Superficial, follow the veins, except those of the middle of the lower lip, which open directly into the Digastric Glands.

The Lymphatic Glands are always on top of the veins. Around the orifices of the body, the lymphatics of the organs developed from the External Blastoderm discharge into the superficial glands of the organ; those of the Mucous Blastoderm in the deep glands.

On Serous Membranes, lymphatics originate by open extremities.

PECULIARITIES OF THE CAPILLARIES OF SOME
TISSUES AND ORGANS.

(*N. B.*—Unless otherwise mentioned, the blood capillaries are meant.)

TISSUES.

- 508 **Connective Tissue :**

The lymphatics originate in the lymph spaces.

Adipose Tissue :

The capillaries form a globular network around the lobules.

Glandular Tissue :

In the Racemose and Follicular Varieties, the capillaries form a globular network around the lobules.

In the Tubular Glands they run parallel to the tubes.

On cross section they present a radiating appearance.

ORGANS OF DIGESTION.

- 509 **Teeth :**

The capillaries form a characteristic network in pulp.

Tongue :

The capillaries form a characteristic tree-like arrangement.

It is poplar-like, *i. e.*, long and narrow in the conical papillæ.

It is oak-like, *i. e.*, broad and low in the fungiform.

Stomach :

The capillaries of the Tubular Glands alone are peculiar.

Duodenum, Jejunum and Ileum :

The blood vessels form a capillary plexus under the epithelium of the villi, in the substance of the stroma.

The lymphatics, called lacteals, originate by a closed dilated extremity in the centre of the villi.

Anus :

Its venous capillaries are the remotest of the portal system.

Liver :

The capillaries of the Portal Vein and of Hepatic Artery form around each lobule a plexus which sends branches into the interior of the lobule.

The Hepatic Veins originate in the centre of the lobules by the Central Intra-lobular veins, a unique case in the body.

Spleen :

The Arterial Capillaries open into the microscopic alveoles by a free extremity.

There are no Immediate Capillaries proper; they are replaced by microscopic alveoles.

The Venous Capillaries originate by dilated orifices on the inner walls of the microscopic alveoles.

The Lymphatic Capillaries originate from peculiar spaces in the adenoid tissue, called "lymph spaces" between the microscopic alveoles.

ORGANS OF URINATION.

510 Kidney :

The Arterial Capillaries circulate between the Pyramids of Ferrein in a peculiar branching way, and give off the branches which form the Glomerule of Malpighi.

From this Glomerule originates a small capillary vessel, still arterial, which breaks up into a second set of capillaries at the initial point of the tubules. Thus it forms an arterial capillary portal system, a unique instance.

The Venous Capillaries originate from the peritubular plexus and not from the glomerule.

The Superficial Venous Capillaries originate in a star-like arrangement called the Stars of Verheyn.

MALE ORGANS OF GENERATION.

Testicles :

The Capillaries form a vascular layer on the walls of the alveoles before being distributed to the seminiferous tubules (like the pia mater and the periosteum).

Penis :

The Arterial Capillaries have a corkscrew course—and terminate into the microscopic alveoles by open extremities.

The Intermediate Capillaries or Capillaries Proper are replaced by the microscopic alveoles.

The Venous Capillaries originate from the microscopic alveoles by free dilated extremities.

All this as in the spleen.

ORGANS OF RESPIRATION.

511 Lungs:

The Capillaries of the Bronchial Arteries and Veins do not reach the interior of the lobules.

The Capillaries of the Pulmonary Arteries and Veins form three sets of capillaries: one around the lobules, one between the air vesicles, and one under the epithelial plates.

CENTRAL ORGANS OF INNERVATION.

Brain:

The Capillaries form a plexus in the pia mater before penetrating the brain substance.

They are much more abundant in the grey matter.

In the convolution, and especially the lamellæ, they present a characteristic arborescent arrangement.

In the Spinal Cord:

The Capillaries form a plexus in the pia mater before penetrating the nerve tissue.

They are more numerous in the grey matter.

They form two crescent-like sets, united by a transverse set.

ORGANS OF SPECIAL SENSE.

512 In the Nose.

The Tip has no intermediate capillaries, and the arteries empty directly into the veins.

In the Cornea.

There are no capillaries.

There exists a peculiar set of Corneal Corpuscles and anastomosing Canalicules.

In the Choroid.

The Capillaries form a separate special layer, the membrane of Ruysch.—There the capillaries present a peculiar stellate or spoke-like arrangement.

In the Retina.

The Capillaries form a distinct layer, the membrane of Jacobson.

In the Iris.

The Capillaries have a corkscrew-like course.

They form a plexus around the greater circumference and a smaller one around the pupil.

In the Skin.

The Capillaries form peculiar tree-like projections into the papillæ (like the tongue).

N. B.—At the tip of the nose, in the matrix of the nails, at the tip of the fingers and toes the arterioles run directly into venules without the interposition of capillaries proper.

ORGANS OF LOCOMOTION.

513 **In the Bones.**

The Capillaries form a plexus in the periosteum and in the medullary membrane proper before penetrating into the bony tissue.

They penetrate into the bony tissue by the Haversian Canals.

The finest capillaries are in the Haversian Canal.

They do not penetrate into the lacunæ and canalicules.

In the Muscles.

The Capillaries run parallel to the fibres and interchange anastomotic branches.

STRUCTURE OF NERVES.

514 The nerves are composed of an envelope called the Neurilemma, and of contents, the Medulla and the Axis-Cylinder.

The **Neurilemma** is composed of fine, delicate, structureless membrane.

The **Medulla** is a fluid, transparent, fatty substance.

The **Axis-Cylinder** is composed of very fine homogeneous fibrils.

Forms and Varieties.

Neurilemma.—Sometimes it is quite *thick*, and gives the edges of the fibres the aspect of a *double line* (double contour).

Sometimes it is so *thin* as to be considered absent by some (as in the optic and auditory nerves).

Medulla.—In the dead state it is *coagulated*.

Sometimes it is almost *entirely absent*, as in the fibres of the sympathetic (fibres of Remak).

TERMINATION OF NERVES.

515 **By Loops:** is not admitted by all anatomists.

By Free Extremities: *i. e.*, at the end of the nerve the axis-cylinder divides into a number of small fibrils (vestibular nerves).

By **End Bulbs of Krause**: *i. e.*, minute corpuscles in the interior of which the axis-cylinder passes and terminates in a coiled plexiform mass, or in a bulbous extremity (mucous membrane).

By **Tactile Corpuscles**: *i. e.*, minute bodies which are similar to the end bulbs, but complete in structure and more highly sensitive.

By **Pacinian Corpuscles**, composed of a capsule of many concentric layers of connective tissue and fluid, presenting in the centre a cavity in which the axis-cylinder terminates in a bulbous extremity (palm of hand—genitals—mesentery).

By **Hair-Cells**: *i. e.*, the axis-cylinder terminates into a nerve cell, the other extremity of which gives off a number of delicate fibrils (taste-goblets, middle scale of ear, olfactory nerve).

By peculiar **Rods and Cones**, as in the retina.

STRUCTURE OF NERVOUS GANGLIA.

- 516 Nervous Ganglia are formed of an **Envelope** of fibrous tissue, and of **Nerve Cells**, whose poles receive the axis-cylinder of nerves.

RESUME OF THE CRANIAL NERVES.

- 517 1st. **Olfactory**. It originates from the anterior perforated space.—It runs along the olfactory groove,—it terminates by an enlargement called the bulb.

From the bulb are given off filaments which descend through the cribriform plate and are distributed to the upper third only of the Schneiderian Membrane.—The filaments terminate in the peculiar hair cells.

- 518 2d. The **Optic**. It originates from the quadrigeminate bodies and optic beds.

It winds around the peduncles of the cerebrum.—the two nerves join to form the chiasma, where the fibres decussate.

The *Optic Nerve Proper* is round;—it starts from the chiasma, enters the orbit through the optic foramen with the ophthalmic artery,—strikes the eyeball a little below and to the inner side of the axis,—passes through the sclerotic,—expands to form the retina.—It finally terminates in peculiar bodies, called the rods and cones.

- 519 3d. The **Common Ocular Motor**. It originates from the inner side of the cerebral peduncles.

It passes through the cavernous sinus—it enters the orbit through the sphenoidal fissure.—It is distributed to the

sphincter of the iris and to all the muscles in the orbit, except the superior oblique and the external straight.

- 520 **4th. Pathetic.** It originates from the valve of Vieussens.—It winds around the cerebral peduncle,—it passes through the cavernous sinus,—it enters the orbit through the sphenoidal fissure.

It is distributed to the superior oblique alone.

- 521 **5th. Tri-facial.** It originates from the middle peduncle of the cerebellum by a *large sensory root*, which expands to form the Gasserian ganglion,—and by a *small motor root* which is independent and joins the inferior maxillary nerve beyond the Gasserian ganglion, to be distributed specially to the masticator muscles.

The **Gasserian Ganglion** gives off the ophthalmic nerve, the superior and the inferior maxillary nerves.

- 522 The **Ophthalmic** passes through the cavernous sinus;—it enters the orbit through the sphenoidal fissure,—and is distributed to the ophthalmic ganglion, the lachrymal gland, the skin of the forehead (the frontal nerve) and the skin of the wing of the nose (the nasal nerve).

It presents the *Optic* or *Lenticular Ganglion*, situated on the side of the optic nerve;—its branches are the *Ciliary Nerves* to the iris.

The **Superior Maxillary** leaves the cranium through the round foramen.

It bridges over the speno-maxillary fossa.

It runs through the infra-orbital canal;—it emerges upon the face at the infra-orbital foramen to become the *Infra-orbital* nerve;—it is distributed to the skin of the middle third of the face.—In the speno-maxillary fossa it gives off a branch to Meckel's ganglion.

Collateral Branches: To the upper teeth and to the skin of the temple.

It presents the *Spheno-Palatine* or *Meckel's Ganglion*, situated between the nerve and speno-palatine foramen;—its filaments are distributed to the nasal cavities, palate and pharynx.

The **Inferior Maxillary** comes out through the oval foramen.—It gives off: 1st, branches to the masticator muscles;—2d, branches to the ear and temple (the auriculo-temporal);—3d, the gustatory or lingual to the tongue, which receives the cord of the tympanum, and the filaments of which terminate in the taste corpuscles or goblets;—4th, the inferior dental to the lower teeth.

It presents the *Otic* or *Arnold's Ganglion*, situated on the inner side of the inferior maxillary nerve, and supplying the pterygoids and the tensor of the palate.

- 523 **6th. External Ocular Motor or Abductor.** It originates from the groove between the Varolian bridge and the anterior pyramid.

It passes through the cavernous sinus and enters the orbit through the sphenoidal fissure.

It is distributed to the external straight muscle alone.

- 524 7th. **Facial.** It originates from the floor of the cerebellar ventricle.

It enters the internal auditory canal;—it passes through the aqueduct of Fallopius, where it gives off the cord of the tympanum to the gustatory;—comes out through the stylo-mastoid foramen;—winds around the ramus of the jaw;—passes through the parotid gland to its anterior border, and it divides into branches.

It is distributed to all the *cutaneous* muscles of the face, *i. e.*, muscles with a bony origin and a cutaneous insertion.

- 525 8th. **Auditory.** It originates from the floor of the cerebellar ventricle;—it runs through the internal auditory canal in close apposition to the facial;—it is distributed to the membranous vestibule and the membranous cochlea;—in the cochlea its filaments terminate in the peculiar hair cells.

- 526 9th. **Glosso-pharyngeal.** It originates from the groove between the olivary body and the restiform body.

It leaves the cranium through the jugular foramen;—it passes in front of the internal carotid artery.

It is distributed to the muscles and mucous membrane of the pharynx and also to the mucous membrane at the back part of the tongue.

- 527 10th. **Pneumo-gastric.** It originates from the respiratory tract, below the glosso-pharyngeal.

It leaves the cranium through the jugular foramen;—it descends behind the internal jugular vein and internal carotid artery and primitive carotid;—it passes down between the subclavian vein and artery on the right, and on the left between the vein and the arch in front of the left common carotid;—upon entering the chest it follows the œsophagus—and it reaches the stomach.

The left nerve reaches the liver;—the right nerve the solar plexus.

Collateral Branches are: 1st, the *Pharyngeal* to the pharynx;—2d, the *Superior Laryngeal* to the crico-thyroid muscle alone and to the mucous membrane;—3d, the *Inferior* or *Recurrent Laryngeal*, which winds around the subclavian artery on the right and the arch of the aorta on the left, ascends between the trachea and the œsophagus and is distributed to all the muscles of the larynx, except the crico-thyroid;—4th, the *Cervical* and *Thoracic Cardiac nerves*;—5th, the *Æsophageal*;—6th, the *Bronchial* and *Pulmonary* branches.

- 528 11th. **Spinal Accessory.** It originates from the lower part of the respiratory tract of Bell.

It leaves the cranium through the jugular foramen.

It passes outward.

It is distributed to the sterno-mastoid and trapezius.

- 529 12th. **Hypoglossal.** It originates from the groove between the anterior pyramid and the olivary body.

It comes out through the anterior condyloid foramen;—it descends between the vein and artery;—it crosses the external carotid;—it runs parallel to the lingual artery and terminates in the tongue.

Collateral Branches to the muscles of the infra-hyoid region (*descendens noni*) after anastomosing with a branch from the cervical plexus.

RESUMÉ OF THE SPINAL NERVES.

- 530 The *Posterior* or *Sensory Roots* originate from the posterolateral grooves.

They present a *Ganglion* in the intervertebral foramen.

The *Anterior* or *Motor Roots* originate from the anterolateral groove.

They join the posterior branch beyond the ganglion.

The *Two Sets of Roots* form a *Single Nerve* which, at its emergence from the intervertebral foramen, divides into 1st, a *Posterior Branch*, distributed to the muscles of the back; 2d, an *Anterior Branch*, which anastomose together and form the spinal plexuses: cervical, brachial, lumbar, sacral.

CERVICAL PLEXUS.

- 531 It is formed by the anastomoses of the anterior branches of the first four cervical nerves.

It gives off *muscular* branches to the surrounding muscles, and *cutaneous* branches to the skin of the mastoid region, ear, neck, clavicle and acromion.

The two most remarkable branches are:

1st. The *Phrenic*, which originates from the third and fourth;—descends in front of the anterior scalene;—passes between the subclavian vein and artery on the right, and the vein and the arch of the aorta on the left;—it lies between the pericardium and the pleura;—it ends in the diaphragm.

2d. The *Branch which anastomoses with the Descendens Noni* from the hypoglossal (*communicans noni*).

BRACHIAL PLEXUS.

- 532 It is formed by the anastomoses of the anterior branches of the lower four cervical and first dorsal nerves.

It is situated between the scalenes, above the subclavian artery and vein.—Lower down it surrounds the axillary artery.

Collateral Branches: Are all muscular and distributed to the neighboring muscles.

Terminal Branches: Are the internal cutaneous nerves, the circumflex, the musculo-spiral, the musculo-cutaneous, the median and the ulnar.

INTERNAL CUTANEOUS NERVES.

Are distributed to the skin of the inner region of the arm.

CIRCUMFLEX.

It winds around behind the neck of the humerus.

It is distributed to the deltoid and small round muscle.

MUSCULO-SPIRAL.

It follows the spiral groove of the humerus;—it reaches the elbow,—where it divides into the radial and posterior interosseous.

The *Radial* follows the long supinator to the wrist, where it turns backward and is distributed to the back of all the fingers, except the little finger and the outer half of the ring finger.

The *Posterior Interosseous* passes through the short supinator and is distributed to all the muscles of the back of the forearm.

MUSCULO-CUTANEOUS.

It perforates the coraco-brachial.

It descends between the biceps and brachial muscle;—it reaches the outer part of the elbow;—it is distributed to the skin of the outer region of the forearm.

MEDIAN.

It descends between the fascia and the brachial artery, crossing the artery obliquely;—at the elbow it passes under the arch of the round pronator,—descends between the superficial and the deep flexors to the wrist;—there it is in front of the tendons;—it passes under the carpal ligament;—it is distributed to the muscles of the thumb and to the skin of the palmar surface of all the fingers, except the little finger and the outer half of the ring finger.

ULNAR.

It descends along the internal intermuscular septum to the elbow;—it passes under the two heads of the ulno-carpal flexor;—it follows this muscle to the wrist on the inner side of the pisiform bone.

It is distributed to the muscles of the little finger and to the skin of the palm of the little finger and inner half of the ring finger.

Above the wrists it gives off a *branch which turns to the back* and is distributed to the skin of the back of the same fingers.

Below the wrist it gives off a *deep branch*, which passes down into the palm of the hand with the deep branch of the ulnar artery;— it supplies all the deep muscles of the palm of the hand, except the outer two lubricals.

INTERCOSTAL NERVES.

- 533 They are the anterior branches of the upper dorsal nerves. They accompany the intercostal arteries in the intercostal spaces.

They give off a branch to the *Sympathetic* and the *Lateral Cutaneous Nerves* to the thorax.

LUMBAR PLEXUS.

- 534 *It is formed* by the anterior branches of the upper four lumbar nerves.

It is situated in the substance of the psoas muscle, in its posterior portion.

Collateral Branches are :

1st. The *Ilio-hypogastric*, the *Ilio-Inguinal*, the *External Cutaneous* and the *Genito-crural*, which supply the lower abdominal walls, the skin of the upper part of the thigh and of the scrotum.

2d. The *Obturator*, which follows the obturator artery.

Terminal Branch : Is the anterior *Crural Nerve*.

It comes out under Poupart's ligament, lying on the inner side of the psoas and in the same sheath;— it lies to the outer side of the femoral artery.

It is distributed to the muscles and skin of the anterior region of the thigh, and also to the skin of the internal region of the leg by means of the *Saphenous Nerve*, which travels in the sheath of the vessels to the knee, where it becomes subcutaneous.

SACRAL PLEXUS.

- 535 *It is formed* by the anterior branches of the last lumbar and the four upper sacral nerves.

It is situated in the pelvis, in front of the pyriform muscle.

Collateral Branches : Are distributed to the muscles of the buttock — and to the skin of the back of the leg through

the *Small Sciatic*, which follows the ischiatic artery and becomes subcutaneous below the popliteal space.

Terminal Branch: Is the **Great Sciatic Nerve**.

Situation: In front of the pyriform muscle.

Course and Divisions: It leaves the pelvis through the lower part of the great sacro-sciatic notch, below the pyriform muscle;—it is placed midway between the great trochanter and the ischiatic tuberosity,—it descends along the back part of the thigh, resting on the great adductor and covered over by the biceps;—at the lower third of the thigh it divides into the internal and external popliteal nerves.

The *Internal Popliteal* continues the course of the nerve to the arch of the soleus;—there it becomes the *Posterior Tibial* nerve, which descends along with the posterior tibial artery;—behind the internal malleolus it becomes the *Plantar Nerve*, which divides into the *Internal* and the *External Plantar Nerves*.

The *External Popliteal Nerve* (or *Peroneal Nerve*) follows the tendon of the biceps;—it pierces the origin of the long peroneal muscle,—and divides into the *Anterior Tibial Nerve*, which follows the anterior tibial artery—and the *Musculo-cutaneous*, which passes forward between the peroneal muscles and extensor of the toes and, piercing the fascia, becomes cutaneous.

Distribution: In short, the Great Sciatic Nerve is distributed to the skin of the posterior region of the thigh, and of all the leg and foot, except the internal region of the leg; to the muscles of the posterior region of the thigh, and of all the leg and foot.

GREAT SYMPATHETIC NERVE.

536 It forms a **Chain of Ganglia** connected by nerves—extending from the base of the cranium to the coccyx.

The most important ganglia are the *Upper, Middle* and *Inferior Cervical*.

It is situated on the side of the vertebral column.

Afferent Branches. Each ganglion receives a communicating branch from the anterior branch of a spinal nerve.

Efferent Branches. Each ganglion gives off:—1st, the *filaments which accompany the Arteries and their Branches*, which form plexuses around them, and thus reach the viscera;—2d, *Branches having an Independent Course:* the three *Sympathetic Cardiac* nerves, originating from the *cervical* ganglia—and the three *Splanchnic Nerves*, which originate from the lower thoracic ganglion, pierce the diaphragm and terminate in the solar plexus.

PECULIARITIES OF NERVES IN PARTICULAR.

CRANIAL NERVES.

537 The **Olfactory** :

Is a soft nerve.

It presents a grey bulb.

It is transmitted through a cribriform plate.

Its terminal fibrils end in hair-cells between the epithelium.

The **Optic** :

Is a soft nerve.

It has a long white root called the optic bandelette.

It is pierced by the Central Artery of the Retina, a unique case.

It terminates into a papilla.

It expands to form the retina.

Its terminal fibrils are the rods and cones.

The **Common Ocular Motor** :

It passes through the cavernous sinus.

The **Pathetic** :

Is remarkably small.

Presents a peculiar, long course.

It also passes through the cavernous sinus.

It is distributed to one muscle only, the Great Oblique, which receives no other supply.

538 The **Tri-facial** :

It presents a Sensory Root, which alone forms the Gasserian Ganglion.

The Motor Root does not enter the ganglion.

This motor root supplies the masticator muscles only.

The Three Divisions present each a Ganglion: the Optic or Lenticular, Meckel or Spheno-palatine, Arnold or Otic.

It gives rise to a nerve of special sense, the Gustatory, a unique instance of a nerve of special sense coming from another nerve.

The Gustatory anastomoses with the facial (a motor nerve), through the Cord of the Tympanum, a unique instance of the anastomose of a motor nerve with a nerve of special sense.

The terminal fibrils of the Gustatory or Lingual end into peculiar bodies, the Taste-Goblets.

The Ophthalmic Branch of the Tri-facial traverses also the cavernous sinus.

It is the only nerve that gives off the three kinds of branches, motor, sensory and special sense.

The **External Ocular Motor** :

It traverses also the cavernous sinus.

It is distributed to one muscle only, the External Straight.

The Facial :

It presents a peculiar course through the Internal Auditory Canal, through the Aqueduct of Fallopius, and through the Parotid Gland.

It gives rise to the Cord of the Tympanum.

It supplies all the cutaneous muscles of the face, head and neck.

The Auditory :

It is a soft nerve (like the olfactory and optic).

Between it and the facial is found the peculiar nerve of Wrisberg.

It penetrates into a bony canal, the Internal Auditory Canal.

It penetrates into the Vestibule and the Cochlea, through cribriform plates (like the olfactory).

Its fibrils end in nerve cells in the Vestibule, between the Auditory dust or otoliths (a unique instance).

They end in the Cochlea in a peculiar manner, in the liquid of the middle scale.

539 **The Glosso-Pharyngeal :**

It originates from the respiratory tract.

It winds around the internal carotid, between it and the internal jugular vein.

The Pneumo-gastric :

It has a long course.

It originates from the respiratory tract.

It descends behind the Carotid and the Jugular.

It gives rise to the Recurrent Laryngeal.

It takes support on the œsophagus.

The Left terminates into the liver.

The Right terminates into the Solar plexus.

It has an extensive distribution, to almost all the organs supplied also by the Great Sympathetic (respiration circulation, digestion).

For that reason it is called by some the Small Sympathetic.

The Spinal Accessory :

Originates from the respiratory tract, *i. e.*, from the sides of the cervical portion of the spinal cord.

It ascends back into the cranial cavity.

It divides at the exit from the jugular foramen into the branches to the Sterno-mastoid, and the branch which is the real origin of the recurrent laryngeal nerve.

The Hypoglossal :

Goes through a foramen by itself.

Winds around the jugular vein and the internal carotid.

Below it crosses the external carotid.

Further on it is parallel to the lingual artery.

It gives off the Descendens Noni.

PECULIARITIES OF THE SPINAL NERVES.

- 540 The Posterior or Sensory Root** presents a ganglion.
The Anterior or Motor Root joins the posterior root beyond the ganglion (like the Gasserian Ganglion).
The Posterior Spinal Branches:
 Are almost all small and comparatively unimportant.
The Superficial Branches of the Cervical Plexus:
 Are cutaneous.
The Deep Branches.
 Are muscular.
 The Phrenic is the most important: it is peculiar in its course.
The Brachial Plexus.
 Has collateral branches which are all muscular.
 The terminal branches go to the upper extremity.
The Musculo-Cutaneous.
 Pierces the coraco-brachial (like the radial and the musculo-cutaneous of lateral popliteal).
The Median:
 Prongs the axillary artery.
 It crosses obliquely, the brachial artery being on top.
The Circumflex:
 Winds around the neck of the humerus.
 It supplies the deltoid only, which receives no other supply.
The Musculo-Spiral winds around the spiral groove of the humerus.
The Radial winds around the head of the radius and the short supinator.
 It is the only nerve supplying the extensors of the hand.
The Ulnar can be compressed between the ulnar and humerus at the elbow.
- 541 The Intercostal Nerves:**
 Present perforating branches which are the painful spots in intercostal neuralgia.
The Lumbar Plexus:
 Gives rise to one important branch only, the Crural.
The Sacral Plexus:
 Gives rise to one important branch only, the Great Sciatic.
 This Great Sciatic is the largest and the longest nerve in the body.
 It supplies the four-fifths of the lower extremity.
 It accompanies no large artery nor vein.
The Musculo-Cutaneous Branch winds around the head of the fibula and the peroneal muscles (like the radial).
The Internal Popliteal
 Is on top of the Popliteal vein and artery.
 It crosses the artery obliquely.

GREAT SYMPATHETIC.

It originates from ganglions and from branches from the spinal nerves.

They form Peculiar Plexuses presenting Peculiar Ganglions.

The Branches from these Plexuses take support upon the arteries to reach their final distribution.

RESUMÉ OF SURGICAL ANATOMY.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST
CONCERNING THE REGION OF THE SKULL.

- 542 1st. The **Superior Longitudinal Sinus** corresponds to a line drawn over the head, from the nasal protuberance to the external occipital protuberance.
- 2d. The **Lateral Sinuses** correspond to an horizontal line drawn from the external occipital protuberance to the anterior border of the mastoid process.
- 3d. The **Middle Meningeal Artery** corresponds to a point about an inch and a half behind the external angular process of the frontal bone, and an inch and a half above the zygoma.
- 4th. The **Lower Level of the Anterior Lobe in Front** corresponds with a straight line drawn across the forehead, just above the eyebrows.
- 5th. The **Lower Level of the Middle Lobe** corresponds to a line drawn from the external angular process of the frontal bone to the upper part of the external auditory canal.
- 6th. The **Lower Level of the Posterior Lobe** corresponds to a line drawn from the meatus to the occipital protuberance.
- 7th. The **Cerebellum** is situated below this line.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST
CONCERNING THE REGION OF THE FACE.

- 543 1st. The **Supra-orbital Notch** corresponds to the junction of the inner third with the middle third of the orbital margin.
- 2d. The **Infra-orbital Foramen** corresponds to the root of the first bicuspid of the upper jaw.
- 3d. The **Mental Foramen** corresponds to the root of the first bicuspid of the lower jaw.

4th. The **Facial Artery** is felt at the anterior inferior angle of the masseter.—Its course is represented by a line extending from that angle to the corner of the mouth, then along the naso-labial fold to the wing of the nose; thence the internal angle of the eye.

5th. The **Facial Vein** runs a straight course represented by a line extending from the internal angle of the eye to the anterior inferior angle of the masseter.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE REGION OF THE ZYGOMATIC AND PTERYGO-MAXILLARY FOSSÆ.

544 1st. **Steno's Duct** runs one-quarter of an inch below the zygoma.

2d. **Beyond the Masseter and Ramus of the Jaw** is the zygomatic fossa,—in which are found the inferior dental nerve, the pterygoid muscles, the internal maxillary artery, and the lingual or gustatory nerve.

3d. **Beyond the Zygomatic Fossa** is found the pterygo-maxillary fossa,—which contains the termination of the internal maxillary artery, the superior maxillary nerve and Meekel's ganglion.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE REGION OF THE PAROTID.

545 1st. **Steno's Duct** emerges from the anterior border of the gland, about one-third of an inch below the zygoma.

2d. The **Facial Nerve** crosses its substance in the upper third.

3d. The **Temporal Artery** emerges from its substance in front of the tragus.

4th. The **External Carotid** is between it and the inner part of the neck of the condyle.

5th. The **Internal Maxillary** is situated between it and the condyle of the jaw.

6th. The **Internal Jugular**, the **Internal Carotid**, the **Glosso-pharyngeal**, **Pneumo-gastric**, **Spinal Accessory**, and **Hypoglossal** correspond to the deep part of its posterior surface.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE REGION OF THE CAROTIDS.

546 The **Carotid** is on the inner side of the internal jugular vein, which overlaps it considerably.

The **Pneumo-gastric** and **Sympathetic** descend into the groove behind the vein and artery.

In the lower third the vessels are entirely covered by the tendons of the sterno-mastoid;— the inferior thyroid artery is behind the carotid.

In the middle third they are covered merely by the anterior border of the sterno-mastoid.

In the upper third the muscle is behind them;— they are under the skin and fascia.— There the common carotid divides.

The external carotid is crossed by the hypoglossal nerve; — it gives off the superior thyroid, lingual, and facial.— The jugular vein receives there the superior thyroid, lingual and facial veins, which cross over the arteries to reach the jugular.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE LATERAL SUPRA-HYOID REGION (DIAGASTRIC TRIANGLE).

- 547 1st. The **Facial Artery** crosses the posterior extremity of the submaxillary gland.
 2d. The **Hypoglossal Nerve** is above and parallel to the upper border of the hyoid bone.
 3d. The **Lingual Artery** has the same course as the nerve, but is underneath the fibres of the hyoglossus muscle.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE INFRA-HYOID REGION.

- 1st. The **Isthmus** of the thyroid body crosses the second and third rings of the trachea.
 2d. The **Anterior Jugular** and the *Middle Thyroid* artery sometimes run on the middle line.
 3d. The **Innominate Vein and Artery** in children are superficial on the right of the lower part of this region.
 4th. The **Thymus** in children is also superficial.
 5th. The **Recurrent Laryngeal Nerve** is in the groove between the trachea and œsophagus.

The **External Jugular Vein** crosses the region obliquely, downwards and backwards.

Its course is represented by a line extending from the space between the condyle and the auditory canal to the middle of the clavicle, behind the insertion of the sterno-mastoid.

The Sterno-mastoid Muscle is the guide to the region.

The Lymphatic Glands lie under the muscle, on the outer surface of the Internal Jugular Vein. They are small and insignificant in health, but when diseased they are large and become adherent to the vein.

The Internal Jugular Vein is on the outer side of the artery.

It is usually a little adherent to the muscle and follows it when the muscle is pulled away.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE ANTERIOR MEDIASTINUM.

548 **Sternum :**

The *Top* corresponds to the second dorsal vertebra.

The *Junction of the First and Second Pieces* corresponds to the second rib, to bifurcation of the trachea, to the third dorsal vertebra.

The *End of the Sternum Proper* corresponds to the tenth dorsal vertebra and to the lower border of the heart.

Ribs :

The *Nipple of the Male* is between the fourth and fifth ribs, about three-quarters of an inch to the outer side of their cartilages.

The *Lower Border of the Great Pectoral* corresponds with the direction of the fifth rib.

The *Scapular* lies on the ribs from the second to the seventh.

The *Interior Extremity of the Third Rib* corresponds to the body of the sixth dorsal vertebra (and about so for the others).

The *Apex of the Heart* corresponds to the fifth intercostal space.

Lungs :

They leave uncovered a circle two inches in diameter, the centre of which is midway between the nipple and the end of the sternum.

Heart :

The *Parts of the Heart Behind the Sternum* are the pulmonary artery, the arch of the aorta, the inner half of the auricles and the inner half of the ventricles.

The *Parts to the Right of the Sternum* are :

The Outer Half of the Right Auricle corresponding to the third and fourth spaces.

The Superior Cava, corresponding to the first and second spaces.

The *Parts to the Left of the Sternum* are :

The Outer Half of the Ventricles, corresponding to the third, the fourth and the fifth spaces.

The **Base of the Heart** corresponds to the upper border of the third costal cartilage.

The **Apex** corresponds to the fifth intercostal space. It is one inch below the left nipple and one inch to the inner side of it.

The **Lower Border of the Heart** corresponds to the lower end of the second piece of the sternum.

The **Aortic Valves** correspond to the third intercostal space, close to the left side of the sternum.

The **Pulmonary Valves** correspond to the left third costosternal articulation.

The **Tricuspid Valves** correspond to the middle of the sternum, about the level of the fourth cartilage.

The **Mitral Valves** correspond to the third intercostal space, one inch to the left of the sternum.

All the Valves are partially covered by the ear applied over the sternal end of the third intercostal space.

RESUMÉ OF POINTS OF SPECIAL INTEREST CONCERNING THE SUPERIOR MEDIASTINUM.

549 **Organs Contained on the Middle Line:**

Thymus gland,—left innominate vein,—ascending and transverse aorta;—pulmonary artery,—origin of innominate artery and of left carotid,—the trachea and bifurcation,—œsophagus, vertebral column.

Organs Situated on the Right Side:

Sterno-clavicular articulation,—internal mammary artery,—left and right innominate veins,—superior cava;—right subclavian vein and artery,—right lymphatic duct;—phrenic nerve, pneumo-gastric,—recurrent laryngeal,—right vertebral artery,—and sympathetic.

Organs Situated on the Left Side:

Sterno-clavicular articulation,—internal mammary artery,—left innominate vein,—left subclavian vein,—origin of the left common carotid and left subclavian arteries,—thoracic duct,—phrenic,—pneumo-gastric—and recurrent laryngeal nerves, descending aorta,—left vertebral artery—and sympathetic.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE SUPRA-CLAVICULAR REGION.

550 1st. The **Anterior and External Jugular Veins** open into the subclavian behind the junction of the sterno-mastoid and the clavicle.

2d. The **Cephalic Vein** opens above the middle part of the clavicle.

3d. The **Anterior Scapular (or Supra-scapular) Artery** runs along the posterior border of the clavicle.

4th. The **Posterior Scapular** crosses obliquely over the subclavian artery and the nerves, backwards and outwards.

5th. The **Lymphatic Glands** are on the veins.

6th. The **Subclavian Vein** is behind the clavicle.

7th. The **Artery** is behind the vein separated by the tendon of the anterior scalene.

8th. The **Nerves of the Brachial Plexus** are behind and above.

9th. The **Phrenic Nerve** is on the anterior scalene near its inner border.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE INFRA-CLAVICULAR REGION.

551 The **Great Pectoral** lies over the vessels.

The **Vessels** are covered directly by the costo-coracoid membrane and small pectoral muscle.

Inside the Small Pectoral the vein is in front of the artery;—there the cephalic opens into the axillary vein.

Outside of the Small Pectoral the vein is a little below the artery;—the brachial plexus is external to the artery.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE AXILLARY REGION.

552 After cutting through the fascia:

The **Ulnar and the Internal Cutaneous** are on the inner side of the artery.

The **Median Nerve** is commonly on the outer side of the artery; above, its roots embrace the artery like a prong.

The **Lymphatic Glands** are on the vein.

The **Axillary Vein** lies on the inner side of the artery, but almost covering it.

The **Artery** is on the outer side of the vein.

It is parallel and closely applied to the coraco-brachial, which is the guide to it.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE INTERNAL REGION OF THE ARM.

553 After penetrating the fascia:

The **Median Nerve** crosses the artery obliquely so that in the *upper part* of the region it is situated on the outer side of the artery, between it and the edge of the biceps.

In the middle it is on top of the artery and of the veins; sometimes.

At the lower part it is situated at the inner side of the arteries and of the veins.

The Region presents from without inwards;

The **Inner Edge of the Biceps**, which is a guide to the artery.

The **Median Nerve** as explained above.
 The **Brachial Veins** covering the artery almost entirely.
 The **Brachial Artery**.
 The **Internal Aponeurotic Band**.
 The **Ulnar Nerve**.
 The **Inner Head of the Triceps**.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE INTERNAL REGION OF THE BEND OF THE ELBOW.

554 There are two lateral regions or grooves, and one middle region or depression.

The **Internal Lateral Region or Groove**:

Is limited on the inside by the round pronator and on the outside by the biceps.

It presents successively:

The Median Brachial Vein under the skin; it crosses the artery obliquely.

The Expansion of the Biceps.

The Tendon of the Biceps on the outer part of the region.

The Brachial Veins covering the artery.

The Brachial Artery to the inner side of the tendon.

The Median Nerve to the inner side of the artery and next to the round pronator.

The **External Lateral Region or Groove**:

Is limited on the inside by the biceps and on the outside by the long supinator.

It presents the Cephalic Vein under the skin.

Under the fascia it presents the terminal part of the Superior Deep Profunda Artery.

Also the Musculo-spiral nerve.

The **Middle Region or Depression** corresponds to:

The bifurcation of the brachial arteries.

The junction of the deep veins.

The anastomotic branch between the deep veins and the median basilic vein.

The **Subscapular Artery and Vein** are situated on the anterior border of the scapula.

The **Circumflex Artery and Nerve** wind around behind the neck of the humerus.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE WRIST

555 1st. **Anterior Region**. It presents on the *Middle Line* the anterior carpal ligament;—the synovial sac of the flexor tendons,—with the median nerve in front of it.

It presents on the *Ulnar Side* the ulnar artery and nerve outside the tendon of the ulno-carpal flexor and pisiform bone.

It presents on the *Radial Side* the radial artery alone (no nerve) inside the tubercle of the long supinator.

2d. **External Region.** It presents on the radial border the radial artery (without the nerve) which crosses obliquely the pit of the extensor tendons of the thumb.

3d. **Posterior Region.** It presents the tendons of the extensor muscles.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE REGION OF THE PALM OF THE HAND.

556 It presents successively:

1st. The **Superficial Palmar Arch** under the fascia, on a line with the extended thumb.

2d. The **Lower Cul-de-sac of the Synovial Sac.**

3d. The **Deep Palmar Arch** under the tendons, having the same direction as the superficial arch, but one-third of an inch higher up.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE POSTERIOR MEDIASTINUM.

557 1st. **Aorta and Œsophagus:**

Above, the aorta is on the left and the œsophagus is on the right.

In the Middle, the aorta is on the middle line and the œsophagus in front, on the median line also.

Below, the aorta is on the median line still and the œsophagus still also in front of it, but on the left.

2d. The **Pneumo-gastric Nerves** follow the œsophagus.

3d. The **Great Azygos Vein** is situated on the right side of the vertebræ.

4th. The **Thoracic Duct:**

Below, lies between the aorta and the great azygos.

Above, opposite the fourth dorsal vertebra, it ascends to the left of the œsophagus, lying between it and the aorta.

5th. The **Great Sympathetic** lies on the heads of the ribs.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE LATERAL REGION OF THE BACK.

558 1st. The **Space between the Sixth and Seventh Ribs** corresponds to the upper border of the liver.

2d. **Tenth Rib.** The liver comes in contact with the ribs.

3d. The **Eleventh Rib** on the left side corresponds to the lower extremity of the spleen.

4th. **Twelfth Rib.** The most accessible point of the kidney is below the last rib and the outer edge of the spinal erector.

5th. The **Lower Extremity of the Kidney** (also the umbilicus) corresponds to the spine of the *third lumbar vertebra*.

6th. The **Colon** is situated one inch to the outer side of the outer border of the spinal erector.

7th. The **Highest Point of the Ileum** corresponds to about the spine of the fourth lumbar vertebra.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE MIDDLE REGION OF THE BACK OR SPINAL REGION.

559 The **Fourth Cervical Vertebra** (body) corresponds to the end of the pharynx—beginning of œsophagus,—ericoid cartilage,—phrenic nerve,—beginning of brachial plexus. The **Third Dorsal Vertebra**, to bifurcation of trachea,—base of heart,—origin of aortic,—pulmonary arteries,—junction of the two pieces of the sternum.

The **Eighth Dorsal Vertebra**, to aponeurotic centre of diaphragm,—lower border of heart,—lower extremity of sternum (not appendix).

The **Twelfth Dorsal Vertebra**, to the aortic diaphragmatic opening,—cardia,—lowest part of pleura.

The **First Lumbar Vertebra**, to the cœliac axis,—solar plexus,—renal vessels,—pelvis of the kidney.

The **Second Lumbar Vertebra**, to the termination of the spinal cord,—receptacle of the chyle,—pancreas,—duodenum.

The **Third Lumbar Vertebra**, to the umbilicus,—lower border of kidney.

The **Fourth Lumbar Vertebra**, to bifurcation of aorta,—highest point of the ileum.

The **Fifth Lumbar Vertebra**, to promontory of sacrum;—the end of the median spinal foramen corresponds to the interval between the spine of the last lumbar vertebra and that of the first sacral vertebra.

RESUMÉ OF THE ORGANS OF INTEREST CONTAINED IN THE REGIONS OF THE ABDOMEN.

560 **Right Hypochondrium:** Right lobe of liver and gall bladder,—pylorus,—duodenum,—head of pancreas,—right bend of colon,—upper part of right kidney,—supra-renal capsule.

Epigastrium: Middle of left half of liver with its grooves; middle and pyloric end of stomach,—body of pancreas,—aorta,—cœliac axis,—superior mesenteric artery,—solar plexus,—thoracic duct,—pillars of diaphragm.

Left Hypochondrium: Left lobe of liver,—cardia,—large extremity of stomach,—spleen,—tail of pancreas,—left bend of colon,—upper part of left kidney and capsule.

Umbilical Region: Transverse colon,—jejunum,—third portion duodenum,—aorta, ascending cava,—thoracic duct,—fourth lumbar vertebra.

Right Lumbar: Jejunum,—ascending colon,—lower part of right kidney,—pelvis and ureter.

Left Lumbar: Jejunum,—descending colon,—left kidney, lower half;—pelvis and ureter.

Hypogastrium: Ileum,—bladder when distended,—uterus in pregnancy,—rectum on the left,—promontory,—hollow of sacrum, first and second pieces.

Right Iliac: Ileum,—cæcum and appendix,—external iliac vessels.—iliac and psoas muscles.

Left Iliac: Ileum,—sigmoid flexure,—external iliac vessels,—iliac and psoas muscles.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE MALE PERINEUM.

- 561 1st. The **Central Point of the Perineum** corresponds to a point on the raphe, midway between the centre of the anus and the spot where the scrotum joins the perineum.

The perineal muscles all meet there.

The bulb lies above this point.

The artery of the bulb never runs below it.

It corresponds to the membranous urethra in front of the prostate and neck of the bladder.

2d. The **Two Safety Lines of the Perineum** are: 1st, the median line;—2d, the horizontal line passing through the centre of the perineum.

3d. The **Dangerous Zones** are:—1st, on the sides of the middle line and above the transverse line;—2d, along the ascending ramus of the ischium, where the internal pudic artery lies.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE INGUINAL REGION (ILIO-INGUINAL).

- 562 1st. **Poupart's Ligament** corresponds to a line joining the anterior superior spine of the ilium to the spine of the pubis.
2d. The **Lymphatic Glands** are immediately under the skin, on Poupart's ligament.

3d. The **External Abdominal Ring** lies between the spine of the pubis and the angle of the pubis.—It gives passage to the spermatic cord in the male and the round ligament in the female.—It is situated immediately above the spine.

4th. The **Inguinal Canal** contains the spermatic cord in the male and the round ligament in the female.

5th. The **Internal Abdominal Ring** is midway between the anterior superior spinous process of the ilium and the spine of the pubis, and about two-thirds of an inch above Poupart's ligament;—the cord is situated at the lower and internal angle of this ring.—The epigastric vessels are situated on the inner half of this ring.—They correspond to a line drawn from the middle of Poupart's ligament to the umbilicus.

6th. The **Peritoneum** presents usually:—1st, an *External fossa* or depression on the outer side of the epigastric artery, and corresponding to the external abdominal ring;—2d, a *Middle Fossa*, situated between the obliterated umbilical artery and the inner side of the epigastric artery corresponding to the external abdominal ring,—an *Internal Fossa* situated between the obliterated umbilical artery and the urachus.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE UPPER FEMORAL REGION (SCARPA'S TRIANGLE).

563 Under the skin are found :

1st. The **Lymphatic Glands**.

2d. The **Long Saphenous Vein**.

3d. The **Cribriform Fascia**.

4th. The **Opening of the Internal Saphenous Vein** is through the cribriform fascia.

5th. The **Sartorius** is on the outer side of the Crural nerve and of the artery.

It is situated below the inner third of Poupart's ligament, and about one inch and a half external to the pubic spine.

6th. The **Anterior Crural Nerve** is on the outer side, in the sheath of the psoas-iliac muscle.

7th. The **Femoral Artery** is between the nerve and the vein, in the same sheath with the vein.

It corresponds to the upper third of a line extending from the middle of Poupart's ligament to the tubercle of the great abductor.

8th. The **Deep Femoral** is given off about one inch and a half below Poupart's ligament;—it is situated on the posterior and external part.

9th. The **Femoral Vein** is on the inner side of the artery and overlaps it to some extent.

10th. The **Crural Canal** corresponds to the deep lymphatics, and is on the inner side of the vein.

11th. The **Abdominal Opening** of this canal is limited in *front* by Poupart's ligament,—*externally* by the femoral vein,—*posteriorly* by the pubis,— and *internally* by the sharp edge of Gimbernat's ligament.

It is half an inch to the inner side of the femoral artery.

It is about one inch external to the spine of the pubis.

It is below the line of Poupart's ligament.

When the obturator artery originates from the external iliac it curves along the upper and internal portion of the opening.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE INTERNAL REGION OF THE THIGH (MIDDLE THIRD).

564 1st. The **Internal Saphenous Vein** is on the inner part of the region, between the skin and fascia.

2d. The **Sartorius** covers the vessels.

3d. The **Artery** is deeply seated in the groove or angle formed by the adductors and internal vast.

This groove is completed by an aponeurotic arch into a canal (Hunter's canal).

4th. The **Vein** is situated above on the inner side of the artery, but lower down it is behind the artery.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE DORSAL REGION OF THE FOOT.

565 The **Dorsal Artery** is subcutaneous.

It rests on the tarsal bones and is on the outer side of the tendon of the extensor of the great toe.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE UPPER COXO-FEMORAL REGION.

566 The **Top of the Trochanter** corresponds to Nelaton's line, drawn from the anterior superior spine to the most prominent part of the tuberosity of the ischium.—The *head of the femur* faces in the same direction as the internal condyle of the femur.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE GLUTEAL REGION.

1st. **Gluteal Vessels and Nerves.** Their point of emergence corresponds to the inner third of a line drawn from

the posterior superior spine of the ilium to the top of the great trochanter rotated inwards.

2d. The **Ischiatic Vessels** and the **Sciatic Nerve** emerge about half an inch below the gluteal;—the nerve is external to the artery;—they are nearer to the ischium than to the trochanter.

3d. The **Internal Pudic Vessels** and **Nerve** emerge at a point corresponding to the inferior third of a line drawn from the outer side of the ischium to the posterior superior spine;—they are on the inner side of the ischiatic vessels and nerve.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST CONCERNING THE POPLITEAL REGION.

567 Under the skin :

1st. The **External Saphenous Vein** is situated on the middle line of the leg.

It dips down through the fascia and between the heads of the gastrocnemii.

2d. **Above the Ligament of the Joint** the internal popliteal nerve is on the outer side of the vein.

The vein is on the outer side of the artery.

The artery is on the inner side of the vein and is next to the bone. The semi-membranous is the guide to it.

3d. **Opposite the Ligament of the Joint**, between the two condyles of the femur, the nerve is on top of the vein.

The vein on top of the artery.

The artery on top of the ligament.

4th. **Below the Joint**, the nerve is on the inner side.

The vein on the outer side of it.

And the artery on the outer side of the vein, and resting on the popliteal muscle and the tibia.

The internal head of the Gastrocnemius is the guide to it.

5th. The **External Popliteal Nerve** is between the tendon of the biceps and the outer head of the gastrocnemius.

RESUMÉ OF POINTS OF SPECIAL INTEREST CONCERNING THE INTERNAL MALLEOLAR REGION.

568 1st. The **Posterior Tibial Artery** is covered by the skin and fascia,—it is situated between the tendons of the long flexor of the toes and the long flexor of the great toe.

2d. The **Tendon of the Posterior Tibial** is in front, next comes the tendon of the long flexor of the great toe, and then the long flexor of the toes.

RESUMÉ OF THE POINTS OF SPECIAL INTEREST
CONCERNING THE PLANTAR REGION.

- 569 The **External Plantar Artery** is deeply seated, lying next to the bones,—it corresponds to a line drawn from the middle of the internal malleolus to the posterior extremity of the last metatarsal bone.

DEVELOPMENT OF THE OVUM.

RESUMÉ OR GENERAL DESCRIPTION — VITELLINE
MEMBRANE.

- 570 The ovum is composed of the **Vitelline Membrane**, containing the **Vitellus** or **Yolk**.

The ovum meets the spermatozoa in the first third or fourth of the oviduct.

MULBERRY MASS.

- 571 The Vitellus undergoes then a process of **Segmentation** or **Cleavage**, the result of which is to convert the granular contents of the vitellus into a mass of nucleated cells, called the **Mulberry Mass**.

By this time the ovum has reached the uterus.

DECIDUÆ.

- 572 In the uterus, the lining membrane surrounds the ovum in a peculiar manner, and forms the **Decidua Reflex** around the ovum,—the **Decidua Serotina** under the ovum,—and the **Decidua Vera**, which lines the rest of the uterine cavity.

VITELLINE CHORION.

- 573 The **Vitelline Membrane** (or covering of the ovum), which lies immediately beneath the decidua reflex, and the decidua serotina become then covered all over with *rilli*, which are implanted in these deciduæ;—it forms the **First Chorion** or the **Vitelline Chorion**.

This chorion is transitory and disappears as soon as the vessels are developed.

BLASTODERM.

- 574 Now, the cells of the surface of the Mulberry Mass unite together, are flattened and condensed so as to form a mem-

brane called the **Blastoderm**, which lies immediately beneath the vitelline membrane.

On the surface of the blastoderm appears the **Embryonal Spot**, composed of a line called the *Primitive Line of the Embryo*, surrounded by the *Transparent* and the *Dark Areas*.

The blastoderm then divides into two laminæ:

An **External or Serous Lamina**, or **Epiblast**, which will form a part of the embryo, the amnion and the blastodermic chorion,

And the **Internal or Mucous Lamina**, or **Endoblast**, which will form the umbilical vesicle and some of the internal organs of the embryo.

The **Middle Lamina or Mesoblast** is between the two.

AMNION.

- 575 The **External or Serous Blastoderm** forms the **Amnion** and the **Amniotic Cavity** by arching over the two extremities of the embryo and then over the whole of the abdominal and dorsal aspects of the embryo.

That portion of the blastoderm which forms the amnion is the *Reflected Portion*.

That portion which still remains in contact with the vitelline membrane is the *Parietal Portion*.

The space or cavity between the parietal and the reflected portions contains the umbilical vesicle and the allantois.

The cavity formed by the reflected portion, or the amnion, contains the embryo.

BLASTODERMIC CHORION.

- 576 The external surface of the parietal blastoderm becomes covered with innumerable **Hollow Villi**, forming the second or blastodermic chorion.

UMBILICAL VESICLE AND ITS VESSELS.

- 577 As the Amniotic cavity is formed and extends, the **Internal or Mucous Layer** of the blastoderm assumes the form of a pediculated vesicle, which becomes more and more pediculated as the amnion enlarges.

This internal lamina is divided by the abdominal opening or umbilicus of the embryo into two portions:

One is contained in the abdominal cavity of the embryo; —the other expands externally; it forms the **Umbilical Vesicle Proper**.

The membrane of the vesicle bears vessels called the

Omphalo-mesenteric Vessels.

They form the first or transitory circulation of the embryo.

They disappear as soon as the placental vessels are developed.

ALLANTOIS.

- 578 When the amnion is about half formed there originates from the caudal extremity of the embryo a vesicle, which is the **Allantois**.

It rapidly expands, occupies a large portion of the cavity between the amnion and the blastodermic chorion.

As it expands the umbilical vesicle is atrophied.

It bears vessels, the *Umbilical Arteries and Veins*, which belong to the second or permanent circulation of the embryo or placental circulation.

ALLANTOID CHORION.

- 579 The allantois sends membrano-vascular prolongations, which fill the cavity or the hollow villi of the blastodermic chorion.

Those prolongations form the **Third or Vascular Chorion** or the **Allantoid Chorion**.

PERMANENT CHORION.

- 580 The blastodermic chorion and allantoid chorion, uniting together, form the **Permanent Chorion**, so-called because a portion of it ultimately forms the placenta.

As this permanent chorion develops the vitelline chorion and membrane atrophy.

In progress of time the villi of that portion of the blastodermic and allantoid chorions which correspond to the reflex decidua become atrophied and blended with the atrophied vitelline chorion, decidua reflex and decidua vera, which, together with the amnion, form the walls of the amniotic cavity.

PLACENTA.

- 581 The decidua serotina, on the contrary, enlarges considerably, and the villi which correspond to it ultimately form the **Cotyledons or Lobules** of the placenta.

The decidua serotina forms the **Fœtal Portion** of the placenta.

The serotina itself forms the **Maternal Portion** of the placenta.

UMBILICAL CORD.

- 582 As the allantois expands it becomes more and more pediculated.

It is that pedicle, together with the amnion and the remains of the umbilical vesicle, that will form the umbilical cord.

RESUMÉ OF DEVELOPMENT OF THE EMBRYO.

- 583 The **First Trace of the Embryo** is a *Clear Elliptical Spot*, which dilates above and below.

It *presents behind the Vertebral Gutter*, in which the Dorsal Cord lies.—It forms ultimately the intervertebral discs.

It is then converted into a canal by the *Dorsal Laminae*.

The **Abdominal Cavity** of the embryo is closed gradually by the *Ventral Laminae*.

The **Limbs** appear (towards the fourth and fifth week) in the shape of paddles, the pedicle ultimately forming the limb and the expansion the hand and foot.

The **Sides of the Face and the Neck** are closed or formed by the *Branchial Arches* separated by the *Branchial Fissures*.

The **Nose and Middle of Upper Lip** and the incisor teeth are formed by a small bud from the forehead.

The **Drum of the Ear**, the **Eustachian Tube**, the **External Ear** and the **External Auditory Canal** are formed by the first branchial fissure.

The **Teeth Sacs** are depressions of the mucous membrane.—The tooth papilla is the analogue of the skin and hair papilla.—The enamel is secreted by the sac, the dentine by the papilla.—The teeth sacs of the second teeth are offshoots of the sacs of the first teeth.

- 584 The **Œsophagus** is developed independently at the expense of a special agglomeration of cells;—it is at first solid.

The **Stomach, Intestines and Rectum** are formed by the lengthening and coiling up of the intra-abdominal portion of the internal or mucous blastoderm;—from the lower or rectal extremity springs the pedicle of the allantois.

The **Liver** is a pediculated offshoot of the intestines.

The pedicle forms the ducts.

The body is developed by lobules and lobes which fuse together.

The **Spleen** is a diverticle from the stomach.

It is also developed by lobules and lobes which fuse together.

The **Pancreas** originates like the liver.

- 585 The **Supra-renal Capsules** originate independently;—they are at first larger than the kidney, then they diminish in size.

The **Kidneys** originate independently—and by separate lobes which fuse.

The **Pelvis and Ureter** are also developed independently,—and then connect with the kidney and bladder.

The **Bladder** is formed by the dilatation of the origin of the pedicle of the allantois;—the upper portion of the pedicle of the allantois forms ultimately the *urachus*.

The **Urethra** is developed separately with the external genital organs.

- 586 The **Ovaries and Testicles** are developed at the expense of the *Wolffian Bodies*. These are situated in the lumbar region.—They are glandular organs provided with a duct, which opens into the cloaca.

The gland forms the ovaries and testicles,—the duct forms, in the male, the guiding cord,—and in the female the round ligament.

The **Spermatic Canal and Seminal Vesicles** are developed from the *Canals of Muller*,—they extend from the lumbar region to the rectal cavity of cloaca.

The **Fallopian Tubes, Uterus and Vagina** are formed by the coalescence of the two Canals of Muller.

- 587 The **External Organs of Generation** are developed separately and independently from the internal organs,—they coalesce in course of development.

The **Larynx** is developed from the fourth branchial arch. The **Trachea, Bronchi and Lungs** are pediculated offshoots from the œsophagus; the pedicle forms the bronchi and trachea.

The **Thyroid Body** is developed independently.

The **Thymus** also; it diminishes after birth.

- 588 The **Heart** is developed separately;—it is the first organ which acts.

At first it is a cylinder, giving rise above to arteries which supply the embryo and the umbilical vesicle, and receive below the corresponding veins.

When the Allantois and Placenta are developed:

1st. The umbilical vein, which returns arterial blood from the placenta to the ascending cava, gives off a large branch to the *left* branch of the portal vein, through which a large amount of this placental blood goes to the liver.

2d. There exists an orifice between the auricles, through which the blood of the ascending cava vein is directed immediately into the left auricle.

3d. The pulmonary artery is connected with the aorta by a canal (ductus arteriosus), through which half of the blood of the right ventricle is directed immediately into the aorta.

- 589 The **Spinal Cord** is developed from the internal blastoderm in the vertebral gutter.

It is at first a flat membrane, but later on curves its edge and forms a central canal, which becomes obliterated in the course of time.

The **Brain** is developed from the spinal cord by three dilatations or cerebral vesicles.

- 590 The **Membranes of the Eye and the Optic Nerve** are developed from the first cerebral vesicle;—the transparent media are developed independently from the intermediate blastoderm.—The lids and lachrymal apparatus from the skin.

The **Membranous Internal Ear** is an emanation from the third cerebral vesicle;—the osseous labyrinth is developed independently of the petrous bone;—the drum of the ear, Eustachian tube, external and internal auditory canals are formed by the first branchial fissure;—the external ear emanates from the skin.

The **Nose Proper** is formed from the frontal tubercle;—the nasal cavities are formed by the second branchial fissure;—the olfactory nerve (root, bulb, and filaments) is a vesicular prolongation of the first cerebral vesicle.

The **Skin and Appendages** are developed at the expense of the external blastoderm.

- 591 The **Bodies of the Vertebrae** are the first bones which appear on the sides of the dorsal cord, in the vertebral gutter.—Some bones are developed directly into bone, whereas others are first cartilaginous, then bony.—The main parts of bones are developed separately by primary points of ossification.—Secondary parts are developed by supplemental and secondary points on the parts first developed.

As age advances, bones lose organic matter and become light and brittle.

The **Muscles** are developed at the expense of the external blastoderm;—those of the back appear first.

LAWS OF DEVELOPMENT.

- 592 1st. **Law of Unity of Organization and of Transitory Development**, by virtue of which each transitory stage of the development of most of the important organs corresponds to a permanent condition in some of the lower animals.

2d. **Law of Symmetry**, by virtue of which the body generally and each organ, whether single or double, is originally divisible into two parts, each half growing towards the median line, where they meet and fuse.

EPOCH OF APPEARANCE OF THE MAIN ORGANS.

- 593 **First Week**: The ovum reaches the uterus at the end of the first week.

Second Week: The vitelline chorion is formed.

Third and Fourth Weeks: The blastoderm, umbilical vesicle and *first trace of embryo*.

At end of First Month the pancreas, lungs, liver, allantois and Wolffian bodies are developed.

First half of Second Month: The amnion, allantois, genital organs, intestines and lungs are formed.

Second half of the Second Month: Kidney, stomach, spleen, *umbilical cord* and *placenta* are formed.

Third Month: The embryo has acquired *definite shape and all the organs are distinct*.

Fourth Month: The embryo assumes the name of *fœtus*; the *muscles contract* perceptibly and the *fœtal heart is audible*.

594 **At Birth** the bones of the top and sides of cranium are not yet united.

The anterior fontanelle corresponds to the angle of the frontal parietal,

And the posterior fontanelle to the angle of the occipital and parietal bones.

In Résumé:

End of First Week: Ovum reaches the uterus.

End of Fourth Week: First trace of the embryo.

End of Second Half of Second Month: Umbilical cord and placenta are formed.

End of Third Month: The embryo has its definite shape and all the organs are distinct.

End of Fourth Month: The embryo is called a *fœtus*; the muscles contract perceptibly, the *fœtal heart is audible*.

At Birth, as above.

QUESTIONS ON ANATOMY.

GENERAL HISTOLOGY.

1. Describe the Shape and the number of Cells.
2. Give a Resumé of the Structure of Cells.
3. Describe the Vital Properties of Cells.
4. Define Epithelial Tissue.
5. Define Endothelium.
6. Name the Varieties of Connective Tissue.
7. Define Fibrous Tissue.
8. Define Elastic Tissue, its Varieties.
9. Define Adipose Tissue.
10. Name the Varieties and Characters of Glandular Tissue.
11. Describe the Structure of Glands.
12. Describe the Peculiarities of Epithelial Tissue and of Endothelium.
13. Describe the Peculiarities of Connective, Fibrous and Elastic Tissue.
14. Describe the Peculiarities of Adipose Tissue.
15. Describe the Peculiarities of Glandular Tissue.
16. Describe the Guide to Describe an Organ.

DIGESTIVE ORGANS.

17. Name the Organs concerned in Digestion.
18. Describe the Structure of the Lips.
19. Describe the Structure of the Cheeks.
20. Describe the Vestibule.
21. Describe the Number and the Shape of the Teeth.
22. Describe the Structure of the Teeth.
23. Describe the Gums.
24. Describe the Shape, Base, Surfaces and Tip of the Tongue.
25. Describe the Structure of the Tongue.
26. Describe the Hard Palate.
27. Describe the Shape, Surfaces and Borders of the Soft Palate.
28. Describe the Structure of the Soft Palate.
29. Describe the Tonsils.
30. Describe the Shape, Surfaces, Borders, Apex and Base of the Parotid.
31. Describe the Structure of the Parotid.
32. Describe the Shape, Surfaces and Extremities of the Submaxillary Gland.
33. Describe the Structure of the Submaxillary Gland.

34. Describe the Shape, Surfaces and Extremities of the Sublingual Gland.
35. Describe the Structure of the Sublingual Gland.
36. Describe the Shape, Surfaces, Base and Apex of the Pharynx.
37. Describe the Structure of the Pharynx.
38. Describe the Dimensions and Direction of the Œsophagus.
39. Describe the Surfaces, Borders and Extremities of the Œsophagus.
40. Describe the Structure of the Œsophagus.
41. Describe the Shape and Walls of the Cavity of the Abdomen.
42. Describe the Dividing Lines of the Regions of the Abdomen.
43. Name the Organs contained in the Epigastric and Hypochondriac Regions.
44. Name the Organs contained in the Umbilical and Lumbar Regions.
45. Name the Organs contained in the Hypogastric and Iliac Regions.
46. Name the Divisions of the Peritoneum.
47. Name the Folds of the Peritoneum.
48. Name the Viscera invested or not invested by the Peritoneum.
49. Describe the Shape, Surfaces, Borders and Extremities of the Stomach.
50. Describe the Structure of the Stomach.
51. Describe the Shape, Surfaces, Borders and Extremities of the Duodenum.
52. Describe the Structure of the Duodenum.
53. Describe the Shape, Surfaces and Extremities of the Jejunum.
54. Describe the Structure of the Jejunum.
55. Describe the Shape, Surfaces and Extremities of the Ileum.
56. Describe the Structure of the Ileum.
57. Describe the Cæcal Appendix.
58. Describe the Shape, Surfaces, Apex and Base of the Cæcum.
59. Describe the Structure of the Cæcum.
60. Describe the Shape, Surfaces and Extremities of the Ascending Colon.
61. Describe the Shape, Surfaces and Extremities of the Transverse Colon.
62. Describe the Shape, Surfaces and Extremities of the Descending Colon.
63. Describe the Shape, Surfaces and Extremities of the Sigmoid Flexure.
64. Describe the Structure of the Sigmoid Flexure.
65. Describe the Shape, Surfaces and Extremities of the Rectum.

66. Describe the Structure of the Rectum.
67. Describe the Shape, Surfaces and Extremities of the Anus.
68. Describe the Structure of the Anus.
69. Describe the Peculiarities of the Lips and Cheeks.
70. Describe the Peculiarities of the Teeth and Gums.
71. Describe the Peculiarities of the Tongue.
72. Describe the Peculiarities of the Hard and of the Soft Palate.
73. Describe the Peculiarities of the Tonsil and of the Parotid.
74. Describe the Peculiarities of the Submaxillary and Sublingual Glands.
75. Describe the Peculiarities of the Pharynx.
76. Describe the Peculiarities of the Œsophagus.
77. Describe the Peculiarities of the Cavity of the Abdomen and Peritoneum.
78. Describe the Peculiarities of the Stomach.
79. Describe the Peculiarities of the Duodenum.
80. Describe the Peculiarities of the Jejunum and of the Ileum.
81. Describe the Peculiarities of the Ileo-cæcal Valve and of the Cæcal Appendix.
82. Describe the Peculiarities of the Cæcum and of the Colons.
83. Describe the Peculiarities of the Sigmoid Flexure and of the Rectum.
84. Describe the Peculiarities of the Anus.
85. Describe the Peculiarities and Characteristics of the Mucous Membrane and Digestive Tract to the Œsophagus inclusively.
86. Same for the Stomach to the Anus.
87. Describe the Shape, Upper Surface, Upper Border and Lower Border of Liver.
88. Describe the Extremities and the Under Surface of the Liver.
89. Describe the Structure and Excretory Apparatus of the Liver.
90. Describe the Shape, Surfaces, Borders and Extremities of the Pancreas.
91. Describe the Structure of the Pancreas.
92. Describe the Shape, Surfaces, Borders and Extremities of the Spleen.
93. Describe the Structure of the Spleen.
94. Describe the Peculiarities of the Liver.
95. Describe the Peculiarities of the Pancreas.
96. Describe the Peculiarities of the Spleen.

URINARY ORGANS.

97. Name the Urinary Organs.
98. Describe the Supra-renal Capsules.
99. Describe the Shape, Surfaces, Borders and Extremities of the Kidney.

100. Describe the Structure of the Kidney.
101. Describe the Calices.
102. Describe the Pelvis (Renal).
103. Describe the Ureter.
104. Describe the Shape, Surfaces, Apex, Base and Neck of the Bladder.
105. Describe the Structure of the Bladder.
106. Describe the Prostate.
107. Describe the Peculiarities of the Supra-renal Capsules and of the Kidneys.
108. Describe the Peculiarities of the Excretory Apparatus of the Kidneys.
109. Describe the Peculiarities of the Ureters, Bladder and Prostate.
110. Name the Male Organs of Generation.
111. Describe the Structure of the Scrotum.
112. Describe the Testicle.
113. Describe the Epididymis.
114. Describe the Spermatic Duct.
115. Describe the Structure of the Spermatic Cord.
116. Describe the Seminal Vesicles.
117. Describe the Ejaculatory Ducts.
118. Describe the Structure of the Penis.
119. Describe the Male Urethra.
120. Describe Cowper's Glands.
121. Describe the Peculiarities of the Scrotum.
122. Describe the Peculiarities of the Testicle and of the Epididymis.
123. Describe the Peculiarities of the Spermatic Duct, Spermatic Cord, Seminal Vesicles and Ejaculatory Ducts.
124. Describe the Peculiarities of the Penis, of the Male Urethra and of Cowper's Glands.

HEART.

125. Describe the Fibrous Pericardium.
126. Describe the Serous Pericardium.
127. Describe the Shape, Surfaces, Borders, Base and Apex of the Heart.
128. Describe the Structure of the Heart.
129. Describe the Peculiarities of the Pericardium and of the Heart.

ORGANS OF RESPIRATION.

130. Name the Organs of Respiration.
131. Describe the Shape, Base, Apex, Borders, and Surfaces of Larynx.
132. Describe the Structure of the Larynx.

133. Describe the Shape, Surfaces and Extremities of the Trachea.
134. Describe the Structure of the Trachea.
135. Describe the Shape, Surfaces and Extremities of the Bronchi.
136. Describe the Structure of the Bronchi.
137. Describe the Shape, Surfaces, Borders, Base and Apex of the Lungs.
138. Describe the Structure of the Lungs.
139. Describe the Pleura.
140. Describe the Peculiarities of the Larynx.
141. Describe the Peculiarities of the Trachea, of the Bronchi, and of the Lungs.
142. Describe the Peculiarities of the Pleura.
143. Describe the Isthmus of the Thyroid Body.
144. Describe the Lobes of the Thyroid Body.
145. Describe the Structure of the Thyroid Body.
146. Describe the Thymus.
147. Describe the Peculiarities of the Thyroid Body and of the Thymus.

BRAIN AND SPINAL CORD.

148. Name the Membranes of the Brain.
149. Describe the Cerebral Dura Mater
150. Describe the Cerebral Arachnoid
151. Describe the Cerebral Sub-Arachnoid Fluid.
152. Describe the Cerebral Pia Mater
153. Name the Various Parts of the Brain.
154. Describe the Cerebrum.
155. Describe the Callous Body.
156. Give the Boundaries and Divisions of the Cavities of the Cerebrum.
157. Describe the Trigone.
158. Describe the Interposed Veil.
159. Describe the Pellucid Septum.
160. Describe the Lateral Ventricles.
161. Describe the Middle Ventricle.
162. Describe the Pineal Gland.
163. Describe the Quadrigeminal Bodies.
164. Describe the Shape, Surfaces and Circumference of the Cerebellum.
165. Describe the Structure of the Cerebellum.
166. Describe the Varolian Bridge.
167. Describe the Shape, Surfaces, Base and Apex of the Oblong Medulla.
168. Describe the Structure of the Oblong Medulla.
169. Describe the Surfaces and Angles of the Cerebellar Ventricle.
170. Define the Ependyma.

171. Describe the Ventricles.
172. Describe the Peculiarities of the Envelopes of the Brain.
173. Describe the Peculiarities of the Cerebrum, of the Peduncles, of the Callous Body.
174. Describe the Peculiarities of the Cavities of the Cerebrum.
175. Describe the Peculiarities of the Pineal Gland, of the Quadrigeminal Bodies, of the Cerebellum, of the Varolian Bridge, of the Oblong Medulla and of the Cerebellar Ventricle.
176. Describe the Communication of the Ventricles.
177. Name the Membranes of the Spinal Cord.
178. Describe the Dura Mater of the Spinal Cord.
179. Describe the Arachnoid of the Spinal Cord.
180. Describe the Cerebro-spinal Fluid of the Spinal Cord.
181. Describe the Pia Mater of the Spinal Cord.
182. Describe the Shape, Surfaces and Extremities of the Spinal Cord.
183. Describe the Structure of the Spinal Cord.
184. Describe the Peculiarities of the Envelopes of the Spinal Cord.
185. Describe the Peculiarities of the Spinal Cord.
186. Describe the Shape, Surfaces, Borders and Extremities of the Nose.
187. Describe the Structure of the Nose.
188. Describe the Shape, Surfaces and Extremities of the Nasal Cavities.
189. Describe the Structure of the Mucous Membrane of the Nasal Cavities.
190. Describe the Peculiarities of the Nose and Nasal Cavities.
191. Name the Parts Comprising the Eyeball.
192. Describe the Shape, Surfaces and Circumference of the Cornea.
193. Describe the Structure of the Cornea.
194. Describe the Sclerotic.
195. Describe the Shape, Surfaces and Extremities of the Choroid.
196. Describe the Structure of the Choroid.
197. Describe the Shape, Surfaces and Extremities of the Retina.
198. Describe the Structure of the Retina.
199. Describe the Vitreous Body.
200. Describe the Shape, Surfaces and Circumference of the Crystalline Lens.
201. Describe the Structure of the Crystalline Lens.
202. Describe the Shape, Surfaces and Circumference of the Iris.
203. Describe the Structure of the Iris.
204. Describe the Aqueous Humor.
205. Describe the Orbital Fascia.
206. Describe the Muscles of the Eyeball.

207. Describe the Structure of the Eyelids.
208. Describe the Structure of the Eyebrows.
209. Describe the Lachrymal Apparatus.
210. Describe the Peculiarities of the Eyeball and of its Envelopes.
211. Describe the Peculiarities of the Contents of the Eyeball.
212. Describe the Peculiarities of the Appendages of the Eye.
213. Name the Parts forming the Organs of Hearing.
214. Describe the Shape, Surfaces and Extremities of the Pavilion.
215. Describe the Structure of the Pavilion.
216. Describe the Direction, Shape, Surfaces, Borders and Extremities of the External Auditory Canal.
217. Describe the Structure of the External Auditory Canal.
218. Describe the Drum of the Ear.
219. Describe the Ossicles of the Tympanum.
220. Describe the Lining Membrane of the Tympanum.
221. Describe the Mastoid Cells.
222. Describe the Direction, Shape, Surfaces and Extremities of the Eustachian Tube.
223. Describe the Structure of the Eustachian Tube.
224. Describe the Relative Position of the Parts comprising the Internal Ear.
225. Describe the Shape and Surfaces of the Vestibule.
226. Describe the Structure of the Vestibule.
227. Describe the Shape, Surfaces and Extremities of the Semi-circular Canals.
228. Describe the Structure of the Semi-circular Canals.
229. Describe the Shape, Base, Apex and Surfaces of the Cochlea.
230. Describe the Structure of the Cochlea.
231. Describe the Direction, Shape, Surfaces and Extremities of the Internal Auditory Canal.
232. Describe the Structure of the Internal Auditory Canal.
233. Describe the Peculiarities of the External and of the Middle Ears.
234. Describe the Peculiarities of the Internal Ear.
235. Name the Layers of the Skin.
236. Describe the Hair and Follicle.
237. Name the Glands of the Skin.
238. Describe the Structure of the Nails.
239. Describe the Peculiarities of the Skin.
240. Describe the Peculiarities of the Glands of the Skin.
241. Describe the Structure of Cartilage.
242. Describe the Varieties of Cartilage.
243. Describe the Chemical Composition of Bones.
244. Describe the Structure of Bones.
245. Describe the Points of Special Interest concerning the Cervical Vertebrae in General.

246. Describe the First, Second, and Seventh Cervical Vertebrae.
247. Describe the Dorsal Vertebrae in General.
248. Describe the First, Ninth, Tenth, Eleventh and Twelfth Dorsal Vertebrae.
249. Describe the Lumbar Vertebrae.
250. Describe the Points of Special Interest Concerning the Sacrum.
251. Describe the Spine in General.
252. Name the Bones of the Skull.
253. Describe the Vertical Portion of the Frontal Bone.
254. Describe the Horizontal Portion of the Frontal Bone.
255. Describe the Lateral Portions of the Frontal Bone.
256. Describe the Situation of the Ethmoid.
257. Describe the Horizontal Plate of the Ethmoid.
258. Describe the Perpendicular Plate of the Ethmoid.
259. Describe the Lateral Masses of the Ethmoid.
260. Describe the Ethmoid Cells.
261. Describe the Situation of the Sphenoid.
262. Describe the Body of the Sphenoid.
263. Describe the Lesser Wings of the Sphenoid.
264. Describe the Greater Wings of the Sphenoid.
265. Describe the Pterygoid Process of the Sphenoid.
266. Describe the Occipital Bone.
267. Describe the Parietal Bone.
268. Describe the Squamous Portion of the Temporal Bone.
269. Describe the Mastoid Portion of the Temporal Bone.
270. Describe the Petrous Portion of the Temporal Bone.
271. Name the Bones of the Face.
272. Describe the Vomer.
273. Describe the Superior Maxillary Bone.
274. Describe the Nasal Bone.
275. Describe the Lachrymal Bone.
276. Describe the Inferior Turbinated Bone.
277. Describe the Horizontal Portion of the Palate Bone.
278. Describe the Vertical Plate of the Palate Bone.
279. Describe the Malar Bone.
280. Describe the Horizontal Portion of the Inferior Maxilla.
281. Describe the Vertical Portion of the Inferior Maxilla.
282. Give a Resumé of the Situation of the Bones of the Skull.
283. Give a Resumé of the Situation of the Bones of the Face.
284. Name the Sutures of the Skull.
285. Name the Cranio-facial Suture.
286. Describe the Upper Region or Vertex of Skull.
287. Describe the Boundaries of the Lateral Regions of the Skull.
288. Describe the Mastoid Region of the Skull.
289. Describe the Temporal Fossa.
290. Describe the Zygomatic Fossa.
291. Describe the Pterygo-maxillary Fossa.

292. Give the Boundaries of the Inferior Region of the Exterior of the Skull.
293. Describe the Palato-pterygoid Region of the Skull.
294. Describe the Occipital Region of the Skull.
295. Describe the Sphenoidal Region of the Skull.
296. Describe the Petrous Region of the Skull.
297. Describe the Squamous and Mastoid Regions of the Skull.
298. Describe the Orbit.
299. Describe the Nasal Fossæ.
300. Describe the Divisions and the Boundaries of the Interior of the Skull.
301. Describe the Upper Region or Roof of the Interior of the Skull.
302. Describe the Anterior or Frontal Cerebral Fossa.
303. Describe the Middle or Sphenoidal Fossa.
304. Describe the Posterior or Occipital Fossa.
305. Describe the Foramens of the Base of the Interior of the Skull and the Organs Situated therein.
306. Name the Points of Special Interest Concerning the Ribs.
307. Name the Points of Special Interest Concerning the First, Second, Tenth, Eleventh, and Twelfth Ribs.
308. Name the Points of Special Interest Concerning the Sternum.
309. Name the Points of Special Interest Concerning the Clavicle.
310. Name the Points of Special Interest Concerning the Scapula.
311. Name the Points of Special Interest Concerning the Humerus.
312. Name the Points of Special Interest Concerning the Ulna.
313. Name the Points of Special Interest Concerning the Radius.
314. Name the Points of Special Interest Concerning the Carpus.
315. Name the Points of Special Interest Concerning the Metacarpus.
316. Name the Points of Special Interest Concerning the Phalanges.
317. Name the Points of Special Interest Concerning the Innominate Bone.
318. Name the Points of Special Interest Concerning the Pelvis in General.
319. Name the Differences Between the Male and Female Pelvis.
320. Name the Points of Special Interest Concerning the Femur.
321. Name the Points of Special Interest Concerning the Patella.
322. Name the Points of Special Interest Concerning the Tibia.

363. Describe the Muscles of the Fourth Layer of the Back.
364. Describe the Muscles of the Fifth Layer of the Back.
365. Describe the Muscular Layers of the Neck.
366. Describe the Muscles of the Chest.
367. Describe the Muscles of the Shoulder.
368. Describe the Muscles of the Anterior Region of the Arm.
369. Describe the Muscles of the Posterior Region of the Arm.
370. Describe the Muscles of the Anterior Region of the Forearm.
371. Describe the Muscles of the External or Radial Region of the Forearm.
372. Describe the Muscles of the Superficial Layer of the Posterior Region of the Forearm.
373. Describe the Muscles of the Deep Layer of the Posterior Region of the Forearm.
374. Describe the Muscles of the External Region of the Hand.
375. Describe the Muscles of the Internal Region of the Hand.
376. Describe the Muscles of the Middle or Palmar Region of the Hand.
377. Describe the Muscles of Exterior of the Abdomen.
378. Describe the Muscles of the Interior of the Abdomen.
379. Describe the Muscles of the Anterior Region of the Thigh.
380. Describe the Muscles of the Internal Region of the Thigh.
381. Describe the Muscles of the Anterior Region of the Leg.
382. Describe the Muscles of the External Region of the Leg.
383. Describe the Muscles of the Dorsal Region of the Foot.
384. Describe the Muscles of the Gluteal Region.
385. Describe the Muscles of the Posterior Region of the Thigh.
386. Describe the Muscles of the Posterior Region of the Leg.
387. Describe the Muscles of the Internal Regions of the Foot.
388. Describe the Muscles of the External Plantar Region.
389. Describe the Muscles of the Middle Plantar Region.
390. Describe the Peculiarities of the Muscles of the Back, of the Cranial Region, of the Face, of the Temporo-maxillary Region, and of the Pterygo-maxillary Region.
391. Describe the Peculiarities of the Muscles of the Neck and of the Chest.
392. Describe the Peculiarities of the Muscles of the Shoulder and of the Arm.
393. Describe the Peculiarities of the Muscles of the Forearm and Hand.
394. Describe the Peculiarities of the Muscles of the Vertebral Region and of the Abdomen.
395. Describe the Peculiarities of the Muscles of the Interior of the Pelvis, of the Anterior and Internal Regions of the Thigh, of the Anterior and External Regions of the Leg, and of the Back of the Foot.
396. Describe the Peculiarities of the Muscles of the Gluteal Region, of the Posterior Region of the Thigh, of the

Posterior Region of the Leg, and of the Muscles of the Plantar Region.

397. Name the Muscles which are Specially Interesting or Important.
398. Name the Muscles of Special Surgical Importance.
399. Name the Anatomical Elements of the Blood.
400. Describe the Red Blood Corpuscles.
401. Describe the White Blood Corpuscles.
402. Describe the Blood Plates and the Free Nuclei.
403. Describe the General Structure of Arteries.
404. Describe the Structure of Arteries in Particular, according to Size.
405. Describe the Structure of Veins.
406. Describe the Structure of Capillaries.
407. Describe the Divisions of the Systemic Circulation and the Cardiac Circulation.
408. Describe the Pulmonary and Bronchial Circulations.
409. Describe the Aorta.
410. Describe the Branches of the Arch of the Aorta.
411. Describe the Common Carotid.
412. Describe the Situation and Course of the External Carotid.
413. Describe the Branches of the External Carotid.
414. Describe the Situation and Course of the Internal Carotid.
415. Describe the Branches of the Internal Carotid.
416. Describe the Situation and Course of the Subclavian Artery.
417. Describe the Branches of the Subclavian Artery.
418. Describe the Situation and Course of the Axillary Artery.
419. Describe the Branches of the Axillary Artery.
420. Describe the Situation and Course of the Brachial Artery.
421. Describe the Branches of the Brachial Artery.
422. Describe the Radial Artery.
423. Describe the Situation and Course of the Ulnar Artery.
424. Describe the Branches of the Ulnar Artery.
425. Describe the Branches of the Thoracic Aorta.
426. Describe the Branches of the Abdominal Aorta.
427. Describe the Common Iliac Artery.
428. Describe the Situation and Course of the Internal Iliac Artery.
429. Describe the Branches of the Internal Iliac Artery.
430. Describe the Situation and Course of the External Iliac Artery.
431. Describe the Branches of the External Iliac Artery.
432. Describe the Situation and Course of the Femoral Artery.
433. Describe the Branches of the Femoral Artery.
434. Describe the Situation and Course of the Popliteal Artery.
435. Describe the Branches of the Popliteal Artery.
436. Describe the Anterior Tibial Artery.
437. Describe the Dorsal Artery of the Foot.

438. Describe the Posterior Tibial Artery.
439. Describe the External Plantar Artery.
440. Describe the Internal Plantar Artery.
441. Describe the Peculiarities of the Innominate Artery, the Carotids and the Subclavian.
442. Describe the Peculiarities of the Brachial Artery, the Radial and Ulnar.
443. Describe the Peculiarities of the Aorta, the Iliac Arteries, the Femoral, Popliteal and Tibials.
444. Describe the Peculiarities of the Arteries of the Organs of Digestion.
445. Describe the Peculiarities of the Arteries of the Organs of Urination and Generation.
446. Describe the Peculiarities of the Arteries of the Heart, of the Organs of Respiration and of Innervation.
447. Describe the Peculiarities of the Arteries of the Organs of Special Sense and of the Organs of Locomotion and Circulation.
448. Describe the Lines Indicating the Direction of, and the Muscle which is the Guide to, the Innominate Artery, the Common, External, and Internal Carotid Arteries, the Bifurcation of the Common Carotid Artery, the Lingual and the Facial Arteries.
449. Describe the Lines Indicating the Direction of, and the Muscle which is the Guide to, the Subclavian, the Axillary, the Subscapular, the Brachial Arteries, and Radial Artery in the Forearm.
450. Describe the Lines Indicating the Direction of, and the Muscle which is the Guide to, the Radial Artery, the Ulnar and the Palmar Arches.
451. Describe the Lines Indicating the Direction of, and the Muscle which is the Guide to, the Internal Mammary Artery, the Epigastric, the Common Iliac, the External Iliac, the Gluteal Artery.
452. Describe the Lines Indicating the Direction of, and the Muscle which is the Guide to, the Internal Pudic Artery, the Ischiatic, the Bulbous and the Femoral.
453. Describe the Lines Indicating the Direction of, and the Muscle which is the Guide to, the Popliteal Artery, the Anterior Tibial, the Dorsal Artery, the Posterior Tibial, the Peroneal and the Plantar Arch.
454. Describe the Supra-diaphragmatic Circulatory Circuits.
455. Describe the Infra-diaphragmatic Circuits.
456. Describe the Articular Arterial Circles.
457. Enumerate the Most Important Branches of Arteries Necessary to Understand the Establishment of the Collateral Circulation after the Ligature of Arteries Above the Arch.
458. Same of the Arteries Below the Arch.

459. Surgical Collateral Branches of the Main Arteries Above the Arch.
460. Surgical Collateral Branches of the Main Arteries Below the Arch.
461. Describe the Collateral Circulation after the Ligature of the Innominate and of the Carotids.
462. Describe the Collateral Circulation after the Ligature of the Subclavian and of the Axillary.
463. Describe the Collateral Circulation after the Ligature of the Brachial, Radial and Ulnar.
464. Describe the Collateral Circulation after the Ligature of the Iliacs.
465. Describe the Collateral Circulation after the Ligature of the Femorals, Popliteal, Tibials.
466. Describe the Ascending Cava Vein.
467. Describe the Left Innominate Vein.
468. Describe the Right Innominate Vein.
469. Describe the Internal Jugular Vein.
470. Describe the Lateral Sinuses.
471. Describe the Superior Longitudinal Sinus.
472. Describe the Straight Sinus.
473. Describe the Occipital Sinuses.
474. Describe the Cavernous Sinuses.
475. Describe the Classification of the Sinuses.
476. Describe the Anastomoses Between the Intra-cranial and the Extra-cranial Venous Circulation.
477. Describe the Subclavian Vein.
478. Describe the Axillary Vein.
479. Describe the Ascending Cava Vein.
480. Describe the Common Iliac Vein.
481. Describe the Internal and External Iliac Vein.
482. Describe the Femoral Vein.
483. Describe the Popliteal Vein.
484. Describe the Branches of the Popliteal Vein.
485. Describe the Peculiarities of Veins in Particular, to the Veins of the Face Inclusively.
486. Describe the Peculiarities of the Veins of the Neck and of the Remainder of the Veins.
487. Describe the Peculiarities of the Veins of Some Organs, to the Veins of the Liver Inclusively.
488. Describe the Peculiarities of the Veins of the Organs of Urination and Generation.
489. Describe the Peculiarities of the Veins of the Heart.
490. Describe the Peculiarities of the Veins of the Organs of Respiration.
491. Describe the Peculiarities of the Veins of the Central Organs of Innervation.
492. Describe the Peculiarities of the Veins of the Organs of Special Sense.

493. Describe the Peculiarities of Veins of the Bones, Muscles and Vessels.
494. Describe the Structure of Lymphatic Vessels.
495. Describe the Structure of Lymphatic Glands.
496. Describe the Lymph.
497. Describe the Chyle.
498. Describe the Thoracic Duct.
499. Describe the Right Lymphatic Duct.
500. Describe the Lymphatic Glands of the Head.
501. Describe the Lymphatic Glands of the Neck.
502. Describe the Lymphatic Glands of the Upper Extremity.
503. Describe the Lymphatic Glands of the Chest.
504. Describe the Lymphatic Glands of the Abdomen.
505. Describe the Lymphatic Glands of the Pelvis.
506. Describe the Lymphatic Glands of the Lower Extremity.
507. Describe the Peculiarities of the Lymphatics.
508. Describe the Peculiarities of the Lymphatics of the Tissues.
509. Describe the Peculiarities of the Lymphatics of the Organs of Digestion.
510. Describe the Peculiarities of the Lymphatics of the Organs of Urination and of Generation.
511. Describe the Peculiarities of the Lymphatics of the Organs of Respiration and of Innervation.
512. Describe the Peculiarities of the Lymphatics of the Organs of Special Sense.
513. Describe the Peculiarities of the Lymphatics of the Organs of Locomotion.
514. Describe the Structure of Nerves.
515. Describe the Termination of Nerves.
516. Describe the Structure of Nervous Ganglia.
517. Describe the Olfactory Nerve.
518. Describe the Optic Nerve.
519. Describe the Common Ocular Motor.
520. Describe the Pathetic Nerve.
521. Describe the Tri-facial.
522. Describe the Ophthalmic, Superior Maxillary and Inferior Maxillary Nerve.
523. Describe the External Ocular Motor.
524. Describe the Facial.
525. Describe the Auditory.
526. Describe the Glosso-pharyngeal.
527. Describe the Pneumo-gastric.
528. Describe the Spinal Accessory.
529. Describe the Hypoglossal.
530. Describe the Spinal Nerves (Roots).
531. Describe the Cervical Plexus.
532. Describe the Brachial Plexus and Branches.
533. Describe the Intercostal Nerves.
534. Describe the Lumbar Plexus and Branches.
535. Describe the Sacral Plexus and Branches.

536. Describe the Great Sympathetic Nerve.
537. Describe the Peculiarities of the Olfactory Nerve, the Optic, the Common Ocular Motor and Pathetic.
538. Describe the Peculiarities of the Tri-facial, the External Ocular Motor, the Facial and the Auditory.
539. Describe the Peculiarities of the Glosso-pharyngeal, the Pneumo-gastric, the Spinal Accessory and the Hypoglossal.
540. Describe the Peculiarities of the Spinal Nerves.
541. Describe the Peculiarities of the Intercostal Nerves, of the Lumbar and Sacral Plexus and Branches.
542. Describe the Points of Special Interest Connected with the Region of the Skull.
543. Describe the Points of Special Interest Connected with the Region of the Face.
544. Describe the Points of Special Interest Connected with the Zygomatic and Pterygo-maxillary Fossæ.
545. Describe the Points of Special Interest Connected with the Region of the Parotid.
546. Describe the Points of Special Interest Connected with the Region of the Carotids.
547. Describe the Points of Special Interest Connected with the Lateral Supra-hyoid Region.
548. Describe the Points of Special Interest Connected with the Anterior Mediastinum.
549. Describe the Points of Special Interest Connected with the Superior Mediastinum.
550. Describe the Points of Special Interest Connected with the Supra-clavicular Region.
551. Describe the Points of Special Interest Connected with the Infra-clavicular Region.
552. Describe the Points of Special Interest Connected with the Axillary Region.
553. Describe the Points of Special Interest Connected with the Internal Region of the Arm.
554. Describe the Points of Special Interest Connected with the Bend of the Elbow.
555. Describe the Points of Special Interest Connected with the Region of the Wrist.
556. Describe the Points of Special Interest Connected with the Region of the Palm of the Hand.
557. Describe the Points of Special Interest Connected with the Posterior Mediastinum.
558. Describe the Points of Special Interest Connected with the Lateral Region of the Back.
559. Describe the Points of Special Interest Connected with the Middle Region of the Back, or Spinal Region.
560. Describe the Organs Contained in the Region of the Abdomen.
561. Describe the Points of Special Interest Concerning the Male Perineum.

562. Describe the Points of Special Interest Concerning the Inguinal Region.
563. Describe the Points of Special Interest Concerning Scarpa's Triangle.
564. Describe the Points of Special Interest Concerning the Internal Region of the Thigh.
565. Describe the Points of Special Interest Concerning the Dorsal Region of the Foot.
566. Describe the Points of Special Interest Concerning the Upper Coxo-femoral and Gluteal Regions.
567. Describe the Points of Special Interest Concerning the Popliteal Region.
568. Describe the Points of Special Interest Concerning the Internal Malleolar Region.
569. Describe the Points of Special Interest Concerning the Plantar Region.
570. Describe the Vitelline Membrane.
571. Describe the Mulberry Mass.
572. Describe the Decidua.
573. Describe the Vitelline Chorion.
574. Describe the Blastoderm.
575. Describe the Amnion.
576. Describe the Blastodermic Chorion.
577. Describe the Umbilical Cord and its Vessels.
578. Describe the Allantois.
579. Describe the Allantoid Chorion.
580. Describe the Permanent Chorion.
581. Describe the Placenta.
582. Describe the Umbilical Cord.
583. Describe the Development of the First Trace of the Embryo, the Vertebral Gutter, the Abdominal Cavity, the Limbs, the Face, Nose, Lips, Drum of the Ear, Eustachian Tube, External Auditory Canal and External Ear, and the Teeth.
584. Describe the Development of the Œsophagus, Stomach, Intestines, Rectum, Liver, Spleen, Pancreas.
585. Describe the Development of the Urinary Organs.
586. Describe the Development of the Internal Organs of Generation.
587. Describe the Development of the External Organs of Generation.
588. Describe the Development of the Heart.
589. Describe the Development of the Spinal Cord and Brain.
590. Describe the Development of the Organs of Special Sense.
591. Describe the Development of the Bones and Muscles.
592. Describe the Laws of Development.
593. Describe the Epoch of Appearance of the Main Organs and the Condition of the Cranium at Birth.
594. Describe the Appearance at Birth of the Bones of the Cranium.

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